AVT Goldeye

Technical Manual

SWIR Cameras with GigE interface (P)
SWIR Cameras with Camera Link interface (CL)

V2.4.0

2013-July-09

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Contents

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Introduction

This AVT Goldeye Technical Manual describes in depth the technical specifications, dimensions, all pixel formats, image processing, basic and advanced parameters and related subjects.

Note

Please read through this manual carefully.

We assume that you have read already the **How to install a GigE camera (Bigeye/Pearleye/Goldeye)** and that you have installed the hardware and software on your PC or laptop (GigE interface card, cables etc.). For Goldeye CL-... cameras refer to the documentation of the frame grabber manufacturer.

http://www.alliedvisiontec.com/emea/support/downloads/product-literature

Document history

Version	Date	Description
V2.0.0	02.11.11	New Goldeye Technical Manual
V2.1.0	23.01.12	Corrections in Chapter Specifications • Deleted Mono8, corrected manual gain (up to factor 10), added (-0%) in Power requirements, corrected mass in Chapter Goldeye P-008 SWIR / Goldeye P-008 SWIR Cool on page 14 • Added (-0%) in Power requirements, added max. 2.6 A with Goldeye CL-008 SWIR Cool, corrected mass in Chapter Goldeye CL-008 SWIR/ Goldeye CL-008 SWIR Cool on page 16 • Deleted Mono8, added (-0%) in Power requirements, corrected mass in Chapter Goldeye P-032 SWIR Cool / Goldeye P-032 SWIR F-Mount Cool on page 18 • Corrected mass in Chapter Goldeye CL-032 SWIR Cool / Goldeye CL-032 SWIR F-Mount Cool on page 20 • Each pixel is output horizontally two times (instead of four times) in Chapter Goldeye xy-008... models on page 32 • Activate correction data set for Highgain (instead of gain x4) in Chapter Adjust the image processing on page 35
to be continued on next page		

Table 1: Document history

Version	Date	Description
		continued from previous page
V2.1.0 [continued]	23.01.12 [continued]	[continued] • Internal GigE interface instead of GIP1000 module in Table 22: Camera standard feature: AcquisitionControl on page 46 • Gain instead of High speed mode in Table 24: Camera special feature: Gain on page 47 • Trigger mode (instead of Gain) in column GigE feature name in Table 25: Camera special feature: Trigger mode on page 48 • Trigger mode (instead of High speed mode) in Table 25: Camera special feature: Trigger mode on page 48
V2.2.0	30.04.12	• All Goldeye camera model name changed from NIR to SWIR: see throughout the manual • Added pixel format: Mono12: see Chapter Goldeye CL-008 SWIR/ Goldeye CL-008 SWIR Cool on page 16 • Analyze multiple regions: added (*rectangular, circle, ring, line)* in *smart features* in all tables in Chapter Specifications on page 14 • Deleted pixel format: *Mono8* in Chapter Goldeye P-032 SWIR Cool / Goldeye P-032 SWIR F-Mount Cool on page 18 • Added pixel format: Mono12 in Chapter Goldeye CL-032 SWIR Cool / Goldeye CL-032 SWIR F-Mount Cool on page 20

V2.3.0	01.11.12	**Changed frame rates and timings in the following chapters:**
		• Chapter Specifications on page 14
		  – Goldeye P-008/Goldeye CL-008: changed from 100 fps to 118 fps (full resolution), changed exposure time from 32 µs to 5 µs.
		  – Goldeye P-032/Goldeye CL-032: changed exposure time from 64 µs to 5 µs
		• Chapter Camera interfaces on page 37
		• Chapter Data interface on page 42
		•

V2.4.0	2013-May-31	• Updated RoHS (2002/95/EC) to RoHS (2011/65/EU) • Updated Specifications -> Power requirements (inrush current) • Added „Surge“ warning • Corrections derived from terminology alignment • Change of font, necessary due to changes in typeface

Table 1: Document history

Manual overview

This **manual overview** outlines the contents of each chapter of this manual.

- Chapter Contacting Allied Vision Technologies on page 6 lists AVT contact data (phone numbers and URLs) for both:
  - Technical information / ordering
  - Commercial information
- Chapter Introduction on page 7 (this chapter) gives you the document history, a manual overview (short description of each chapter) and conventions used in this manual (styles and symbols). Furthermore you learn how to get more information on **how to install hardware**, available **AVT software** (incl. documentation) and where to get it.
- Chapter Conformity on page 13 gives you information about conformity of AVT cameras (CE, FCC, RoHS).
- Chapter Specifications on page 14 lists camera details and measured spectral transmission diagrams for each camera type.
- Chapter Camera dimensions on page 23 provides CAD drawings of standard housing models (2D drawings), tripod adapter and cross sections of the mounts.
- Chapter Start-up on page 31 describes the first steps to get the camera into operation: camera control signals and camera controls as well as adjusting the image process.
- Chapter Camera interfaces on page 37 describes the control junction (I/O pin assignment), inputs / outputs and trigger features.
- Chapter Image processing on page 54 describes the function of the **Goldeye P-.../Goldeye CL-...** firmware. It is related to the individual modules of image processing and shows in what way the user can control these modules via the serial interface.
- Chapter Basic parameters and commands on page 59 describes the basic configuration options and general commands available for the user, being important for the operation of an ex factory preconfigured camera. Most probably the information stated here will be sufficient for most of the users.
- Chapter Advanced parameters and commands on page 63 describes the advanced configuration of the **Goldeye P-.../Goldeye CL-...** models. For the control of an ex factory set up camera the intervention within the parameters stated here or rather the use of the mentioned commands is only necessary in exceptional cases.
- The appendix: Chapter Command reference on page 76 describes the general command reference of the **Goldeye P-.../Goldeye CL-...** firmware.
- Chapter Index on page 94 gives you quick access to all relevant data in this manual.

Conventions used in this manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

Styles

Style	Function	Example
Bold	Programs, inputs or highlighting important things	**bold**
Courier	Code listings, camera output etc.	`Output`
Courier bold	Commands sent to the camera	**`Command`**
Upper case	Register	REGISTER
Italics	Modes, fields	*Mode*
Parentheses and/or blue	Links	(Link)

Table 2: Styles

Symbols

Note

This symbol highlights important information.

Caution

This symbol highlights important instructions. You have to follow these instructions to avoid malfunctions.

www

This symbol highlights URLs for further information. The URL itself is shown in blue.

Example:

http://www.alliedvisiontec.com

Before operation

We place the highest demands for quality on our cameras.

Target group

This **Technical Manual** is the guide to detailed technical information of the camera and **is written for experts.**

Getting started

For a quick guide how to get started read: **How to install a GigE camera (Bigeye/Pearleye/Goldeye)**. For Goldeye CL-... cameras refer to the documentation of the frame grabber manufacturer.

Note

Please read through this manual carefully before operating the camera.

Safety warnings

Caution

Electrostatic discharge

The camera contains sensitive electronic components that can be destroyed by electrostatic discharge.

Use sufficient grounding to minimize the risk of damage.

Models with Camera Link interface (Goldeye CL-...): First connect CL camera and frame grabber with Camera Link data cable, then supply power to the CL camera.

Caution

Environmental conditions

Operate the camera in dry and dust free environment.

Regarding the signal quality of the camera it is an advantage to operate the camera under constant ambient air temperature (~20 °C).

Beneath or above 20 °C ambient temperature a sufficient heating or cooling may be necessary.

Cooled camera models (Goldeye xy- ... Cool)

The red LED L3 at the backside examinates the sensor peltier cooling state. Also register `T` has this function. If L3 permanently lights up or rather the lowest bit of `T` is set, the sensor's temperature is beyond the optimum range. In this case an additional heating or cooling has to be provided.

Caution

Vacuum

Do not loosen the two hexagon socket screws (M 5) in the front plate.

The vacuum area may get leaky (Cool models only).

Caution

Warranty

The warranty becomes void because of unauthorized tampering or any manipulations not approved by Allied Vision Technologies.

Note

Warm-up period

Depending on the prevailing environmental conditions, some time might pass after the camera start, until the image quality reaches its optimum.

A warm up period of 20 minutes is recommended.

Conformity

Allied Vision Technologies declares under its sole responsibility that all standard cameras of the **AVT Goldeye** family that this declaration relates to, are in conformity with the following standard(s) or other normative document(s):

- CE, following the provisions of 2004/108/EG directive
- RoHS (2011/65/EU)

CE

We declare, under our sole responsibility, that the previously described **AVT Goldeye** cameras conform to the directives of the CE.

Specifications

Note

Timing changes in this chapter are valid:

- **starting SN 00102 (P-032)**
- **SN 00308 (P-008)**
- For older versions: contact AVT Technical Support.

Goldeye P-008 SWIR / Goldeye P-008 SWIR Cool

Caution

Surge

To avoid damage caused by surge, connect the camera to an AC/DC power supply. Use a certified industrial power supply that complies with common industrial standards. Make sure the polarization of the power supply is correct.

During the camera start-up, inrush currents ≥ 4 A can occur for 20 ms. Use a sufficiently dimensioned power supply to avoid damage to the camera.

For the DC signal, use cable lengths less than 30 m. Consider that the voltage drop increases with the cable length.

AVT (or your local dealer) provides suitable power supplies:

http://www.alliedvisiontec.com/emea/products/accessories.html

Feature	Specification
Sensor	InGaAs sensor, progressive scan; electronic full-frame shutter
Effective chip size	**9.6 mm (H) x 7.68 mm (V)**
Cell size	30 µm x 30 µm
Resolution (max.)	320 (H) x 256 (V) full resolution 320 (H) x 160 (V) reduced resolution
Lens mount	C-Mount
Spectral response	900 nm to 1700 nm (SWIR)
Pixel format	Mono12
Frame rate	up to 118 fps full resolution up to 186 fps reduced resolution
Exposure time	5 µs to 100 ms / 5 µs to 1 s

Table 3: Specification Goldeye P-008 SWIR / Goldeye P-008 SWIR Cool

Feature	Specification
Cooling	Goldeye P-008 SWIR Cool only: Peltier cooled +0 °C stabilized
ADC	14 bit
Digital interface	Gigabit Ethernet, IEEE 802.3 1000BASE-T
Smart features	Manual gain (up to factor 10 at short exposure times), built-in correction data sets, gain/offset correction (NUC/non-uniformity) for each pixel, bad pixel correction, background (FPN) correction, continuous mode (image acquisition with maximum frame rate), image on demand mode (triggered image acquisition) With AVT's AcquireControl software: pseudo color LUT with several color profiles, auto contrast, auto brightness, analyze multiple regions (rectangular, circle, ring, line) within the image, plus statistics and histogram
Power requirements	+12 V (-0% / +5%) Goldeye P-008 SWIR: 0.6 A (during camera start-up: inrush current ≥ 4 A for 20 ms, capacitive load < 2000 μF) Goldeye P-008 SWIR Cool: 1.1 A, max. 2.8 A (during camera start-up: inrush current ≥ 4 A for 20 ms, capacitive load < 2000 μF)
Dimensions	Goldeye P-008 SWIR: 89 mm x 90 mm x 71 mm (L x W x H) Goldeye P-008 SWIR Cool: 116 mm x 90 mm x 99 mm (L x W x H) each model incl. connectors, without tripod and lens
Mass	Goldeye P-008 SWIR: 660 g Goldeye P-008 SWIR Cool: 1420 g
Operating temperature	Goldeye P-008 SWIR: +10 °C to +30 °C ambient temperature (without condensation) Goldeye P-008 SWIR Cool: 0 °C to +40 °C ambient temperature (without condensation)
Storage temperature	-30 °C to +70 °C ambient temperature (without condensation)
Relative humidity (operating and storage)	10 % to 95 % without condensation
Regulations	CE, RoHS (2011/65/EU)

Table 3: Specification Goldeye P-008 SWIR / Goldeye P-008 SWIR Cool

Goldeye CL-008 SWIR/ Goldeye CL-008 SWIR Cool

Note

The warranty becomes void because of unauthorized tampering or any modifications not approved by the manufacturer.

Timing changes (frame rates and exposure time) in this chapter are valid **starting SN 00102 (Goldeye P-032) or SN 00308 (Goldeye P-008).**

Caution

Surge

To avoid damage caused by surge, connect the camera to an AC/DC power supply. Use a certified industrial power supply that complies with common industrial standards. Make sure the polarization of the power supply is correct.

During the camera start-up, inrush currents ≥ 4 A can occur for 20 ms. Use a sufficiently dimensioned power supply to avoid damage to the camera.

For the DC signal, use cable lengths less than 30 m. Consider that the voltage drop increases with the cable length.

AVT (or your local dealer) provides suitable power supplies:

http://www.alliedvisiontec.com/emea/products/accessories.html

Feature	Specification
Sensor	InGaAs sensor, progressive scan; electronic full-frame shutter
Effective chip size	**9.6 mm (H) x 7.68 mm (V)**
Cell size	30 µm x 30 µm
Resolution(max.)	320 (H) x 256 (V) full resolution 320 (H) x 160 (V) reduced resolution
Lens mount	C-Mount
Spectral response	900 nm to 1700 nm (SWIR)
Frame rate	up to 118 fps full resolution up to 186 fps reduced resolution
Exposure time	5 µs to 100 ms / 5 µs to 1 s
Cooling	Goldeye CL-008 SWIR Cool only: Peltier cooled +0 °C stabilized
ADC	14 bit

Table 4: Specification Goldeye CL-008 SWIR / Goldeye CL-008 SWIR Cool

Feature	Specification
Digital output	12 bit
Digital interface	Camera Link Base
Smart features	Switchable gain (factor 10 at short exposure times), built-in correction data sets, gain/offset correction (NUC/non-uniformity) for each pixel, bad pixel correction, background (FPN) correction, continuous mode (image acquisition with maximum frame rate), image on demand mode (triggered image acquisition) With AVT's AcquireControl software: pseudo color LUT with several color profiles, auto contrast, auto brightness, analyze multiple regions (rectangular, circle, ring, line) within the image, plus statistics and histogram
Power requirements	+ 12 V (-0% / +5%) Goldeye CL-008 SWIR: 0.4 A (during camera start-up: inrush current ≥ 4 A for 20 ms, capacitive load < 2000 μF) Goldeye CL-008 SWIR Cool: 0.9 A (max. 2.6 A) (during camera start-up: inrush current ≥ 4 A for 20 ms, capacitive load < 2000 μF)
Dimensions	Goldeye CL-008 SWIR: 74 mm x 90 mm x 71 mm (L x W x H) Goldeye CL-008 SWIR Cool: 101 mm x 90 mm x 99 mm (L x W x H) each model incl. connectors, without tripod and lens
Mass	Goldeye CL-008 SWIR: 600 g Goldeye CL-008 SWIR Cool: 1400 g
Operating temperature	Goldeye CL-008 SWIR: +10 °C to +30 °C ambient temperature (without condensation) Goldeye CL-008 SWIR Cool: 0 °C to +40 °C ambient temperature (without condensation)
Storage temperature	-30 °C to +70 °C
Relative humidity (operating and storage)	10 % to 95 % without condensation
Regulations	CE, RoHS (2011/65/EU)

Table 4: Specification Goldeye CL-008 SWIR / Goldeye CL-008 SWIR Cool

Goldeye P-032 SWIR Cool / Goldeye P-032 SWIR F-Mount Cool

Note

The warranty becomes void because of unauthorized tampering or any modifications not approved by the manufacturer.

Timing changes (frame rates and exposure time) in this chapter are valid **starting SN 00102 (Goldeye P-032) or SN 00308 (Goldeye P-008).**

Caution

Surge

To avoid damage caused by surge, connect the camera to an AC/DC power supply. Use a certified industrial power supply that complies with common industrial standards. Make sure the polarization of the power supply is correct.

During the camera start-up, inrush currents ≥ 4 A can occur for 20 ms. Use a sufficiently dimensioned power supply to avoid damage to the camera.

For the DC signal, use cable lengths less than 30 m. Consider that the voltage drop increases with the cable length.

AVT (or your local dealer) provides suitable power supplies:

http://www.alliedvisiontec.com/emea/products/accessories.html

Feature	Specification
Sensor	InGaAs sensor, progressive scan; electronic full-frame shutter
Effective chip size	**15.9 mm (H) x 12.7 mm (V)**
Cell size	25 µm x 25 µm
Resolution (max.)	636 (H) x 508 (V)
Lens mount	C-Mount (Goldeye P-032 SWIR Cool) F-Mount (Goldeye P-032 SWIR F-Mount Cool)
Spectral response	900 nm to 1700 nm (SWIR)
Pixel format	Mono12

Table 5: Specification Goldeye P-032 SWIR Cool / Goldeye P-032 SWIR F-Mount Cool

Feature	Specification
Frame rate	up to 30 fps
Exposure time	5 µs to 1 s
Cooling	Peltier cooled - 5 °C stabilized
ADC	14 bit
Digital interface	Gigabit Ethernet, IEEE 802.3 1000BASE-T
Smart features	Switchable gain (factor 20 at short exposure times), built-in correction data sets, gain/offset correction (NUC/non-uniformity) for each pixel, bad pixel correction, background (FPN) correction, continuous mode (image acquisition with maximum frame rate), image on demand mode (triggered image acquisition) With AVT's AcquireControl software: pseudo color LUT with several color profiles, auto contrast, auto brightness, analyze multiple regions (rectangular, circle, ring, line) within the image, plus statistics and histogram
Power requirements	+ 12 V (-0% / +5%), 1.0 A, max. 1.3 A (during camera start-up: inrush current ≥ 4 A for 20 ms, capacitive load < 2000 µF)
Dimensions	Goldeye P-032 SWIR Cool: 115.8 mm x 90 mm x 99 mm (L x W x H) Goldeye P-032 SWIR F-Mount Cool: 145.1 mm x 90 mm x 99 mm (L x W x H) each model incl. connectors, without tripod and lens
Mass	Goldeye P-032 SWIR Cool: 1110 g (with C-Mount) Goldeye P-032 SWIR F-Mount Cool: 1070 g (with F-Mount)
Operating temperature	0 °C to +35 °C ambient temperature (without condensation)
Storage temperature	-30 °C to +70 °C ambient temperature (without condensation)
Relative humidity (operating and storage)	10 % to 95 % without condensation
Regulations	CE, RoHS (2011/65/EU)

Table 5: Specification Goldeye P-032 SWIR Cool / Goldeye P-032 SWIR F-Mount Cool

Goldeye CL-032 SWIR Cool / Goldeye CL-032 SWIR F-Mount Cool

Note

The warranty becomes void because of unauthorized tampering or any modifications not approved by the manufacturer.

Timing changes (frame rates and exposure time) in this chapter are valid **starting SN 00102 (Goldeye P-032) or SN 00308 (Goldeye P-008).**

Caution

Surge

To avoid damage caused by surge, connect the camera to an AC/DC power supply. Use a certified industrial power supply that complies with common industrial standards. Make sure the polarization of the power supply is correct.

During the camera start-up, inrush currents ≥ 4 A can occur for 20 ms. Use a sufficiently dimensioned power supply to avoid damage to the camera.

For the DC signal, use cable lengths less than 30 m. Consider that the voltage drop increases with the cable length.

AVT (or your local dealer) provides suitable power supplies:

http://www.alliedvisiontec.com/emea/products/accessories.html

Feature	Specification
Sensor	InGaAs sensor, progressive scan; electronic full-frame shutter
Effective chip size	**15.9 mm (H) x 12.7 mm (V)**
Cell size	25 µm x 25 µm
Resolution (max.)	636 (H) x 508 (V)
Lens mount	C-Mount (Goldeye CL-032 SWIR Cool) F-Mount (Goldeye CL-032 SWIR F-Mount Cool)
Spectral response	900 nm to 1700 nm (SWIR)
Frame rate	up to 30 fps
Exposure time	5 µs to 1 s
Cooling	Peltier cooled - 5 °C stabilized
ADC	14 bit
Digital output	12 bit

Table 6: Specification Goldeye CL-032 SWIR Cool / Goldeye CL-032 SWIR F-Mount Cool

Feature	Specification
Digital interface	Camera Link Base
Smart features	Switchable gain (factor 20 at short exposure times), built-in correction data sets, gain/offset correction (NUC/non-uniformity) for each pixel, bad pixel correction, background (FPN) correction, continuous mode (image acquisition with maximum frame rate), image on demand mode (triggered image acquisition) With AVT's AcquireControl software: pseudo color LUT with several color profiles, auto contrast, auto brightness, analyze multiple regions (rectangular, circle, ring, line) within the image, plus statistics and histogram
Power requirements	+ 12 V (+5%), 0.8 A, max. 1.1 A (during camera start-up: inrush current ≥ 4 A for 20 ms, capacitive load < 2000 µF)
Dimensions	Goldeye CL-032 SWIR Cool: 100.8 mm x 90 mm x 99 mm (L x W x H) Goldeye CL-032 SWIR F-Mount Cool: 130.1 mm x 90 mm x 99 mm (L x W x H) each model incl. connectors, without tripod and lens
Mass	Goldeye CL-032 SWIR Cool: 1050 g (with C-Mount) Goldeye CL-032 SWIR F-Mount Cool: 1010 g (with F-Mount)
Operating temperature	0 °C to +35 °C ambient temperature (without condensation)
Storage temperature	-30 °C to +70 °C ambient temperature (without condensation)
Relative humidity (operating and storage)	10 % to 95 % without condensation
Regulations	CE, RoHS (2011/65/EU)

Table 6: Specification Goldeye CL-032 SWIR Cool / Goldeye CL-032 SWIR F-Mount Cool

Spectral sensitivity

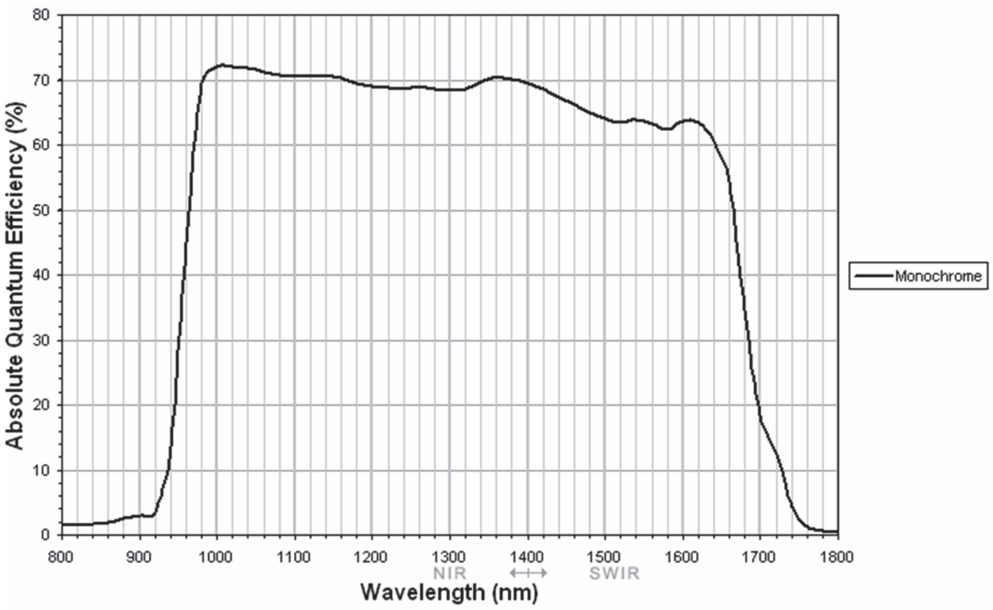


Figure 1: Spectral sensitivity of **Goldeye P-008 SWIR / Goldeye P-008 SWIR Cool / Goldeye CL-008 SWIR / Goldeye CL-008 SWIR Cool**

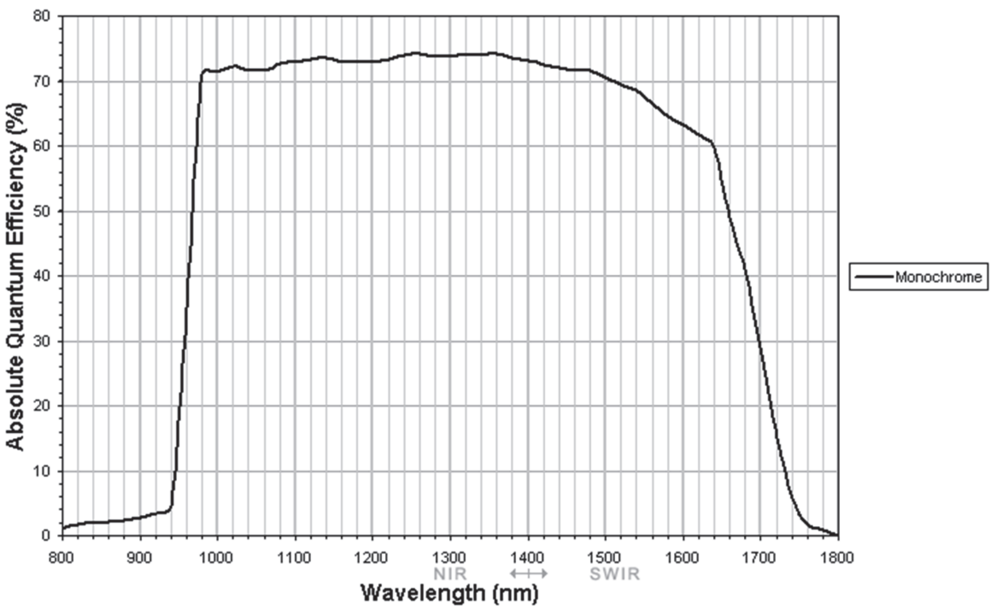


Figure 2: Spectral sensitivity of **Goldeye P-032 SWIR Cool / Goldeye P-032 SWIR F-Mount Cool / Goldeye CL-032 SWIR Cool / Goldeye CL-032 SWIR F-Mount Cool**

Camera dimensions

Goldeye P-008 SWIR
Goldeye CL-008 SWIR

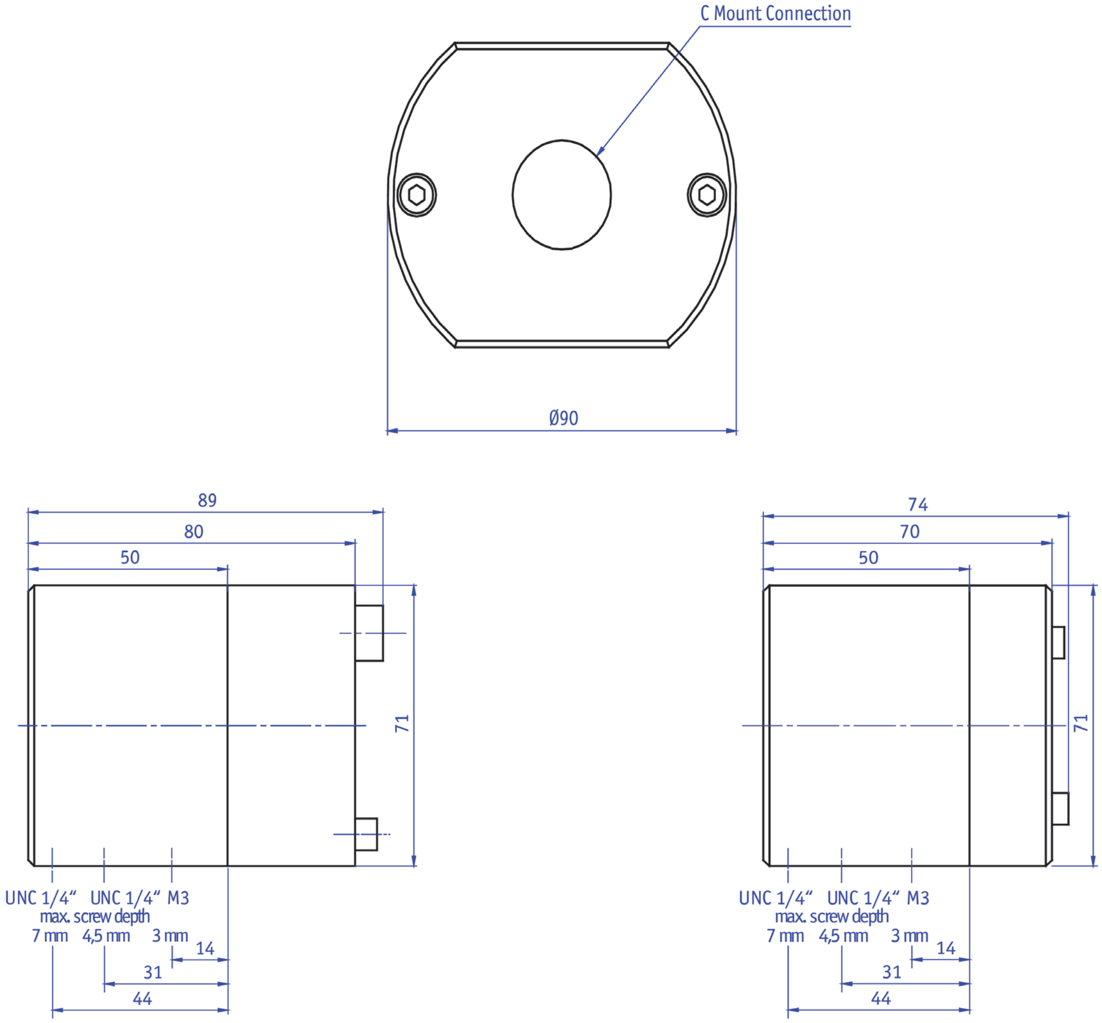


Figure 3: Camera dimensions: Goldeye P-008 SWIR
Goldeye CL-008 SWIR (front/side GigE/side CL)

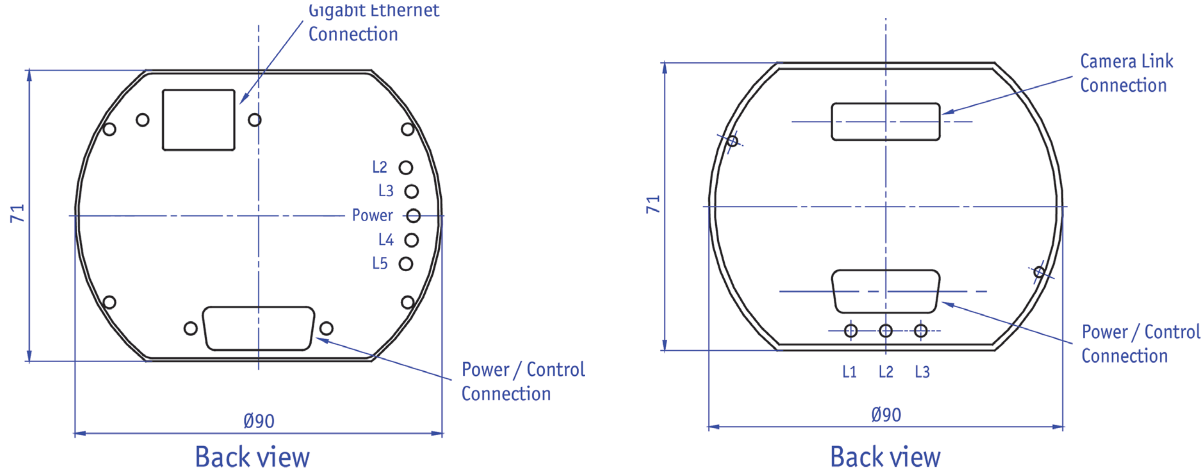


Figure 4: Camera dimensions: Goldeye P-008 SWIR
Goldeye CL-008 SWIR (back GigE/back CL)

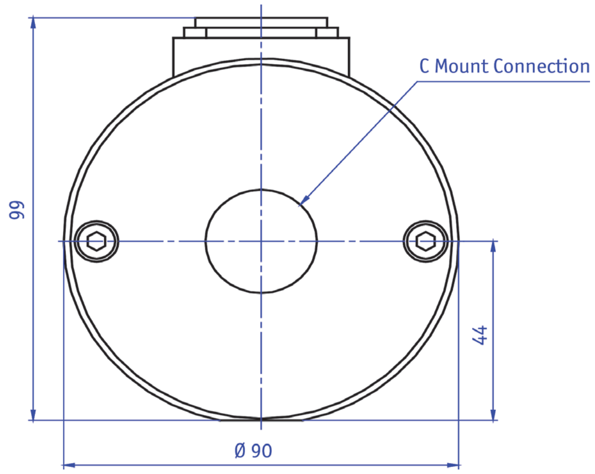
LED	Color	Description
L2	Red	Camera is operational
L3	Red	Continuous mode: on: continuous off: image on demand
Power	Green	Power indicator
L4	Red	Trigger input activity
L5	Red	Frame output activity

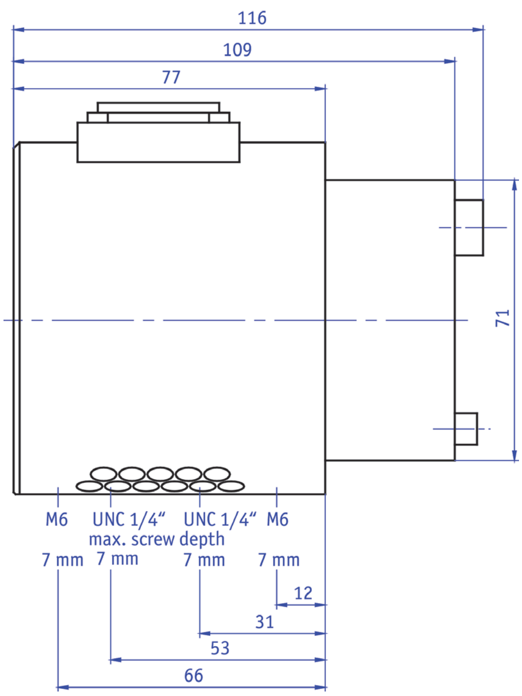
Table 7: Description of LEDs: Goldeye P-008 SWIR

LED	Color	Description
L1	Green	Power indicator
L2	Red	Camera is operational
L3	Red	Continuous mode: on: continuous off: image on demand

Table 8: Description of LEDs: Goldeye CL-008 SWIR

Goldeye P-008 SWIR Cool
Goldeye CL-008 SWIR Cool





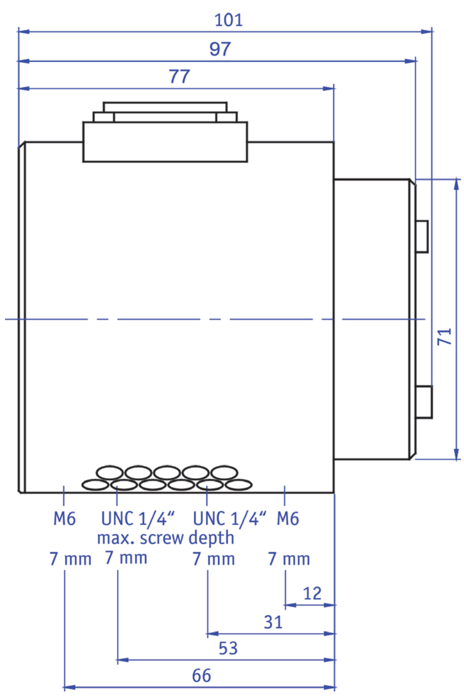
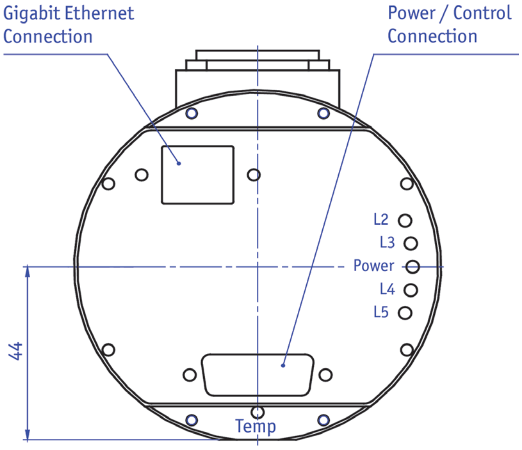


Figure 5: Camera dimensions: Goldeye P-008 SWIR Cool
Goldeye CL-008 SWIR Cool (front/side GigE/side CL/back GigE/back CL)



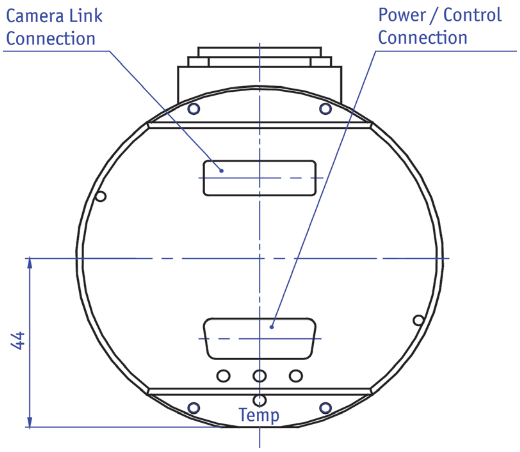


Figure 6: Camera dimensions: Goldeye P-008 SWIR Cool
Goldeye CL-008 SWIR Cool (back GigE/back CL)

LED	Color	Description
L2	Red	Camera is operational
L3	Red	Peltier cooling state off: sensor temperature is OK
Power	Green	Power indicator
L4	Red	Trigger input activity
L5	Red	Frame output activity

Table 9: Description of LEDs: Goldeye P-008 SWIR Cool

LED	Color	Description
L1	Green	Power indicator
L2	Red	Camera is operational
L3	Red	Peltier cooling state off: sensor temperature is OK

Table 10: Description of LEDs: Goldeye CL-008 SWIR Cool

Goldeye P-032 SWIR Cool
Goldeye CL-032 SWIR Cool

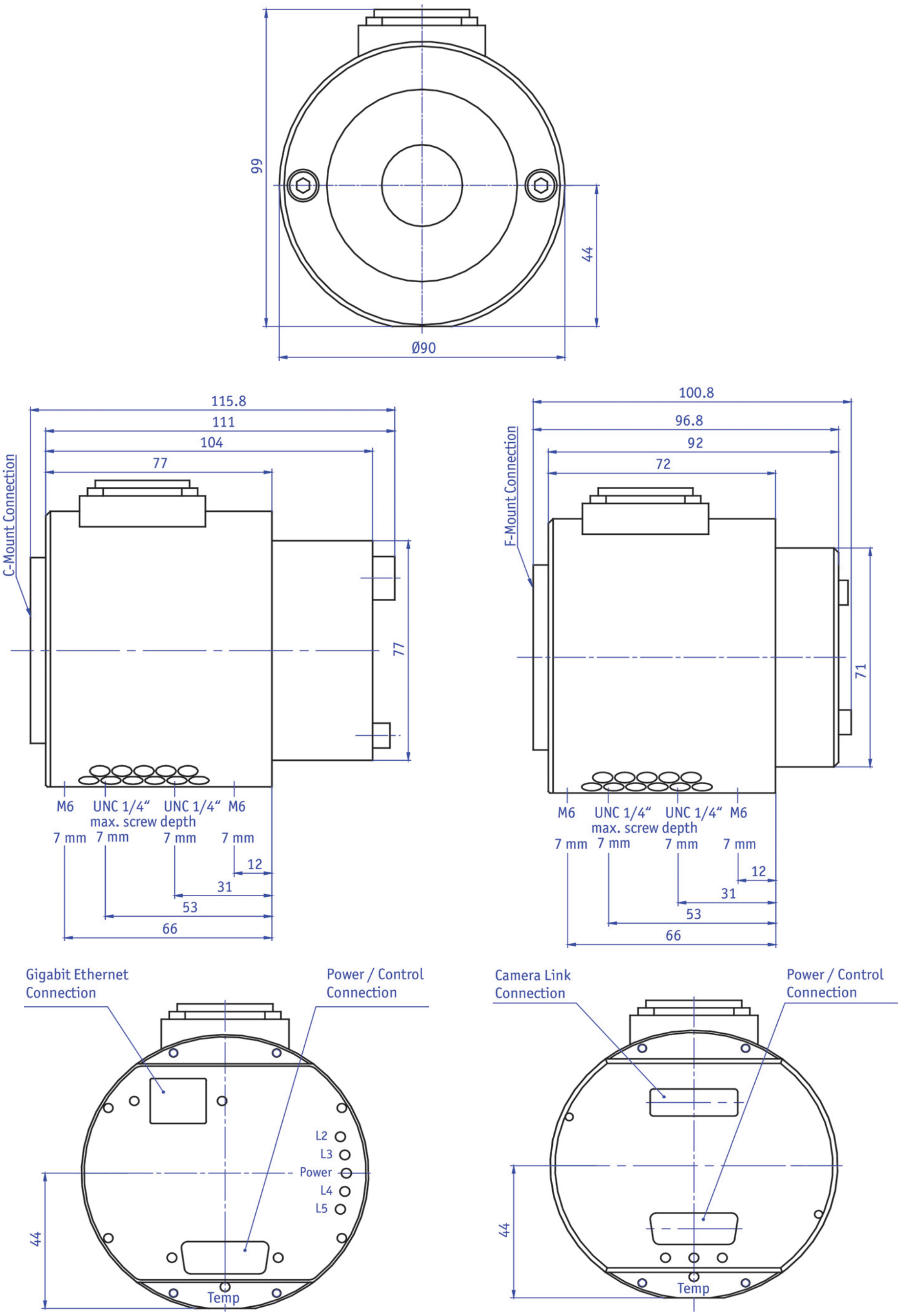


Figure 7: Camera dimensions: Goldeye P-032 SWIR Cool / Goldeye CL-032 SWIR Cool (front/side C-Mount GigE/side C-Mount CL/back GigE/back CL)

LED	Color	Description
L2	Red	Camera is operational
L3	Red	Peltier cooling state off: sensor temperature is OK
Power	Green	Power indicator
L4	Red	Trigger input activity
L5	Red	Frame output activity

Table 11: Description of LEDs: Goldeye P-032 SWIR Cool

LED	Color	Description
L1	Green	Power indicator
L2	Red	Camera is operational
L3	Red	Peltier cooling state off: sensor temperature is OK

Table 12: Description of LEDs: Goldeye CL-032 SWIR Cool

Goldeye P-032 SWIR F-Mount Cool
Goldeye CL-032 SWIR F-Mount Cool

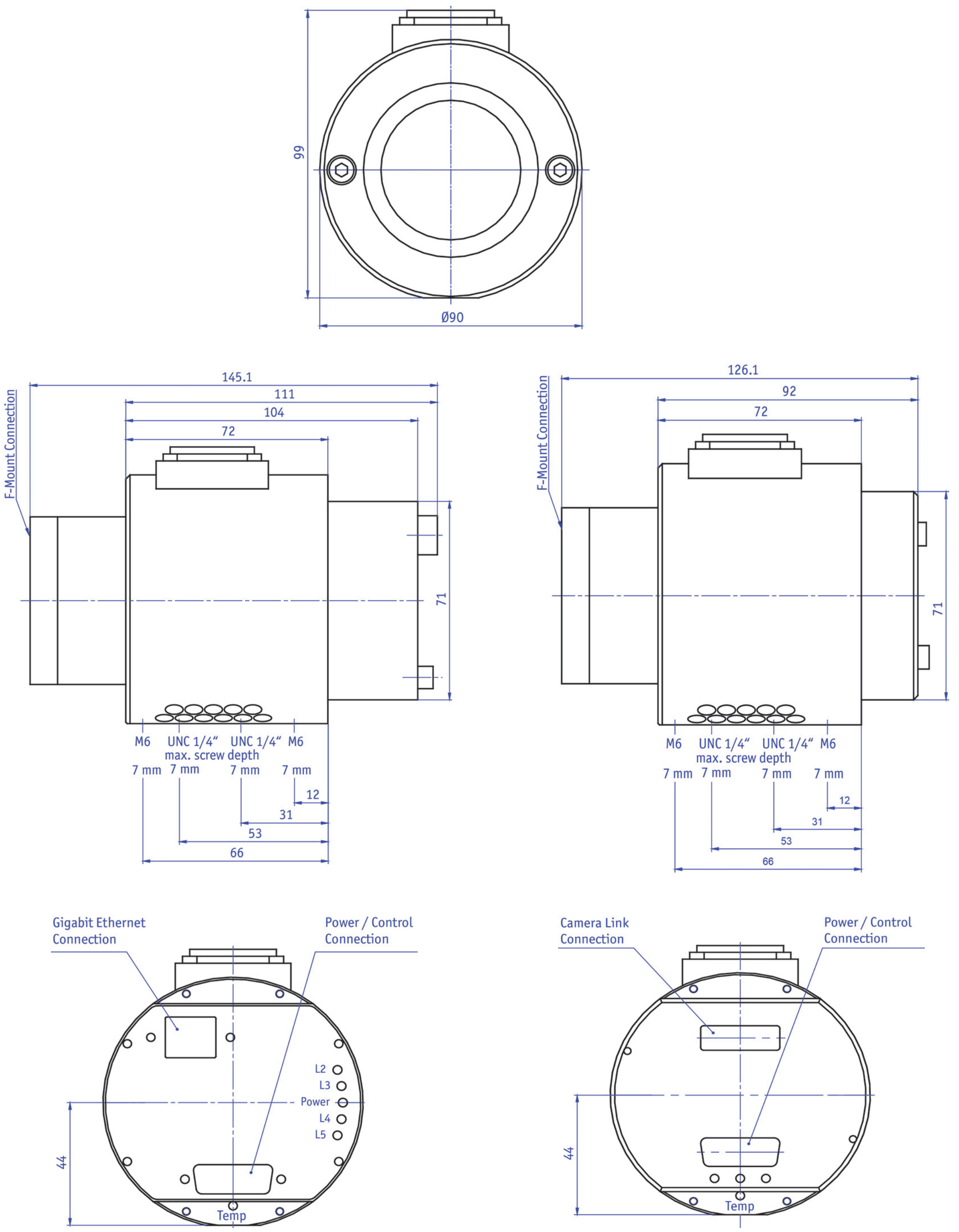


Figure 8: Camera dimensions: Goldeye P-032 SWIR F-Mount Cool / Goldeye CL-032 SWIR F-Mount Cool (front/side F-Mount GigE/side F-Mount CL/back GigE/back CL)

LED	Color	Description
L2	Red	Camera is operational
L3	Red	Peltier cooling state off: sensor temperature is OK
Power	Green	Power indicator
L4	Red	Trigger input activity
L5	Red	Frame output activity

Table 13: Description of LEDs: Goldeye P-032 SWIR F-Mount Cool

LED	Color	Description
L1	Green	Power indicator
L2	Red	Camera is operational
L3	Red	Peltier cooling state off: sensor temperature is OK

Table 14: Description of LEDs: Goldeye CL-032 SWIR F-Mount Cool

Start-up

Depending on the camera interface a Camera Link frame grabber or a a Gigabit Ethernet port (1000Base-T) on the host computer is necessary.

1. Connect the camera with the appropriate data cable to the computer.
2. Plug the 15-pin connector of the power supply to the camera.
3. Switch on the power supply.

Camera Link interface

The camera is controlled in two different ways: direct camera control signals (called CC1 to CC4) on the one hand and more complex commands transferred over a serial data interface on the other hand. For applying serial commands to the camera, a serial terminal program can be used.

Gigabit Ethernet interface

The camera functions are controlled via GigE Vision features that are internally mapped to the CC1 to CC4 signals or the corresponding serial commands.

Refer to the corresponding chapters to learn more about GigE feature mapping.

Note

For more information see:

Chapter GigE Vision feature mapping to serial commands on page 88

Chapter GigE Vision feature reference for AVT Goldeye cameras on page 89

Direct camera control signals

A short survey of the CC signals is given below for users who already have some experience in using Camera Link equipment and who plan to use the **Goldeye** camera with their self-developed software.

Some of the CC signals can also be externally applied to the 15-pin D-sub connector.

Goldeye cameras with Gigabit Ethernet interface use the same CC signals, but they are mapped to corresponding GigE Vision features.

Goldeye xy-008... models

Signal	State	Description	More information
CC1	0	Trigger input (rising edge)	See Chapter Trigger input (CC1) on page 44
CC2	0	320 x 160 pixels (*)	See Chapter High-speed mode (CC2) Goldeye xy-008 only on page 46 See Chapter Timing (FVAL, LVAL, DVAL, PCLK) on page 48
	1	320 x 256 pixels	
CC3	0	Gain x10	See Chapter Gain (CC3) on page 47
	1	Gain x1	
CC4	0	IOD: Image on Demand On	See Chapter IOD mode (CC4) on page 47
	1	IOD: Image on Demand Off (continuous mode)	

Table 15: CC signals (Goldeye xy-008...)

(*) Goldeye CL-008 variants only: The *DVAL* or *Data Valid* signal has to be evaluated by the frame grabber, otherwise the resolution is 640 x 160 (or 640 x 256 respectively) at any time, independent of CC2 (each pixel is output horizontally two times).

Goldeye xy-032... models

Signal	State	Description	More information
CC1	0	Trigger input (rising edge)	See Chapter Trigger input (CC1) on page 44
CC2	-	Reserved	
CC3	0	Gain x20	See Chapter Gain (CC3) on page 47
	1	Gain x1	
CC4	0	IOD: Image on Demand On	See Chapter IOD mode (CC4) on page 47
	1	IOD: Image on Demand Off (continuous mode)	

Table 16: CC signals (Goldeye xy-032...)

Camera control commands

To configure the internal image processing, a serial command interface is provided. By default this command interface is internally routed to the Camera Link port, but the RS232 signals at the 15 pin D-sub connector may also be used.

Camera Link To access it, a serial terminal program employing the serial port of the Camera Link frame grabber or a PC's RS-232 COM port is required.

Refer to the documentation of the frame grabber manufacturer to get more information about the serial port and how to use it.

Gigabit Ethernet For Gigabit Ethernet the control commands are mapped to GigE Vision features. Refer to the corresponding chapters explaining camera functions throughout this manual. There you learn also more about the GigE feature names.

AcquireControl AVT provides the software AcquireControl: this can operate the camera's serial port also over the Gigabit Ethernet interface or PC standard COM ports. Type <CTRL>+Y to get a camera control terminal window there.

By default the serial interface uses the following parameters:

- 115200 Baud
- 8 data bits
- 1 stop bit
- No parity
- No handshake

The baud rate is factory-adjusted to 115200 but can also be configured to other values (see Chapter Advanced parameters and commands on page 63).

Each command consists of a command letter, followed by an equality sign and a parameter value in hexadecimal number representation.

Note The command letter is **case sensitive**.

Hexadecimal values are always upper case and are 1 to 4 digits long. The command is activated by a carriage return ([CR], ASCII character number 0x0D).

Serial communication operates in echo mode by default. This means that each character received by the module is echoed back to the sender.

The serial commands have the following fixed scheme:

```
>B=wxyz [CR]
```

Sign	Description
B	Command or parameter letter (upper and lower case letter have different meaning)
=	Equals sign (0x3D)
wxyz	1-4 digits long value in hexadecimal number representation (capital letters)
[CR]	Carriage Return (0x0D)
[LF]	Line Feed (0x0A)

Table 17: Scheme of serial commands

Example (activate correction data set number 0):

1. The user sends the four characters

   S=0 [CR]

2. The camera answers with seven characters

   `S=0 [CR] [CR] [LF]>`

3. A terminal program without local echo displays

   `S=0`

   `>`

After successful execution of the command, the command input character `>` is returned. If any error occurred, somewhere previous to the prompt a question mark character `?` is displayed.

At the beginning of a command sequence it is good practice to check the serial communication by sending just a **[CR]** to the camera and verify that the command prompt `>` is returned. There is an input buffer holding a few characters but no hardware handshake. Thus a sequence of commands should not be sent to the camera without awaiting the intermediate input prompts. Otherwise the camera's serial input buffer may overflow.

Adjust the image processing

Subsequently, the important commands for quick starting the image correction of the **Goldeye xy-...** are mentioned. All further parameters and a description of the correction modules can be found in Chapter Image processing on page 54.

The camera is configured ex factory with parameter settings that ensure a basic image correction. Usually the **Goldeye xy-...** is equipped with multiple correction data sets for different operation conditions. The image quality can be improved by activating another correction data set if the conditions of the camera have changed.

The index number of the data set to select depends on the image on demand mode (IOD) setting and exposure time. The assignment between exposure time and correction data set can be listed with the command V=1. By means of the parameter S the address of the active correction data set can be adjusted.

Example

View the correction data information and activate the correction data set for gain 10 and 5ms exposure time (Please note: this is example data, the mapping of data sets may be different from camera to camera):

```
>V=1
PIXEL PROCESSING MODULE
CPU software version .......:        17
Serial number ..............: 0000 006B
FlashAccess driver version .:        10
FPGA software identifier ...: 0001 0109

Type "V=1" at the serial terminal to see this information.

+===================================================+
#           Correction Data Information             #
+===================================================+
# Camera type:          Goldeye xy008 #
# Serial no. :          00014                       #
# Camera temperature:   30 °C                       #
# Date / Sign:          30.05.2007 / JP             #
+===================================================+

+===================================================+
# Command            Description of correction data #
+===================================================+
# S=0                00 Gain x1, Continuous         #
# S=1                01 Gain x1, 1ms                #
# S=2                02 Gain x1, 2ms                #
(...)
# S=D                13 Highgain, 2ms               #
# S=E                14 Highgain, 5ms               #
# S=F                15 Highgain, 10ms              #
```

```
(...)
# S=13              19 Highgain, 100ms             #
+==================================================+
>S=E
>
```

Note

For more information see Chapter Image processing on page 54.

Camera interfaces

This chapter gives you information on the control junction, inputs and outputs and trigger features.

Note

Timing specifications in this chapter are valid:

- **starting SN 00102 (P-032)**
- **SN 00308 (P-008)**
- For older versions: contact AVT Technical Support.

www

For accessories such as cables see:

http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html

Control connector

Camera I/O connector pin assignment (15-pin D-sub connector)

This connector is intended for the power supply as well as for controlling the camera by the user.

Furthermore, some output signals are available, showing the camera state.

Pin	Signal	Direction	Level	Description
1	External Power		+12 V DC (-0% / +5%)	Power supply
2				max. 2.8 A (Goldeye P-008...) max. 1.3 A (Goldeye P-032...) depending on model
3	External GND			
4				
5	---			Reserved (do not connect)
6	---			Reserved (do not connect)
7	RxD	In	RS232	
8	TxD	Out	RS232	

Table 18: Camera I/O connector pin assignment (**Goldeye xy-...**)

Pin	Signal	Direction	Level	Description
9	Mode Input		optocoupler input	
10	Trigger (Reset) Input	-	optocoupler input	
11		+		
12	Exposure Output	-	optocoupler output	
13		+		
14	Line Sync	Out		Active low
15	Frame Sync Output	Out		Active low

Table 18: Camera I/O connector pin assignment (**Goldeye xy-...**)

This connector is intended for the power supply as well as for controlling the camera by the user.

Furthermore some output signals are available, showing the camera state.

Power supply (pin 1-4)

The camera requires 12 V +5% DC. Current consumption depends on model. See Chapter *Specifications* on page 14.

Serial interface (pin 7, 8)

By use of the serial interface at pin 7 and 8 the camera can be controlled externally via a RS232 COM port.

A simple terminal program (e.g. HyperTerminal) is sufficient for manually controlling the camera.

Mode input (pin 9)

The mode input provides a method for switching the camera between the continuous operation and image-on-demand (IOD) mode using an externally applied signal. This input has the same function as the camera control signal CC4. For more information: see Chapter *IOD mode (CC4)* on page 47.

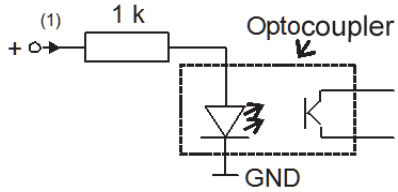


Figure 9: Mode input diagram

The current (1) that flows through the optocoupler and the integrated dropping resistor should be > 5 mA and should not exceed 20 mA.

Input pin 9:

open/GND means continuous operation

5 V ... 20 V means image on demand

Trigger input (pin 10, 11)

This input allows control of the electronic shutter by an externally applied signal. It is necessary to switch the camera into image-on-demand mode to enable direct exposure control. For more information: Chapter *IOD mode (CC4)* on page 47.

The image acquisition is started with approximately 1 µs delay due to the rising edge of the pulse at the trigger input.

Note

this signal is internally combined with the camera control signal CC1 over an OR gate. For more information: see Chapter *Trigger input (CC1)* on page 44.

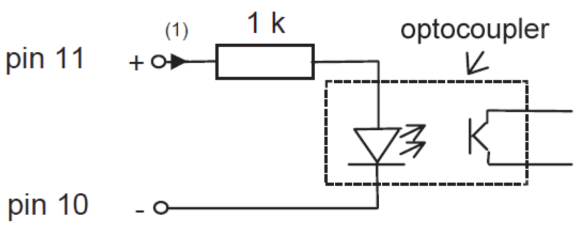


Figure 10: Trigger input diagram

The current (1) that flows through the optocoupler and the integrated dropping resistor should be > 5 mA and should not exceed 20 mA.

Exposure output (pin 12, 13)

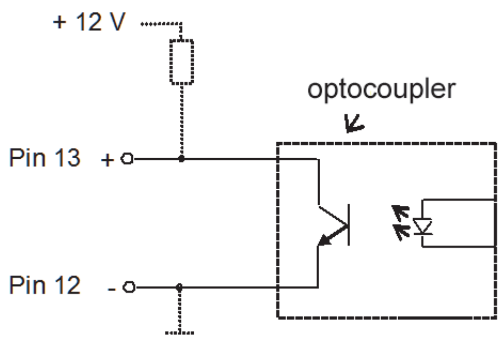


Figure 11: Exposure output diagram

Caution

The current that flows through the optocoupler should not exceed 20 mA (at 12 V, $R_V \geq 600\ \Omega$).

The exposure output indicates the active exposure time of the sensor in the image-on-demand operation.

After end of exposure the 256 (Goldeye xy-008) or 508 (Goldeye xy-032) lines of the sensor are read out to the digital output.

Line-sync output (pin 14)

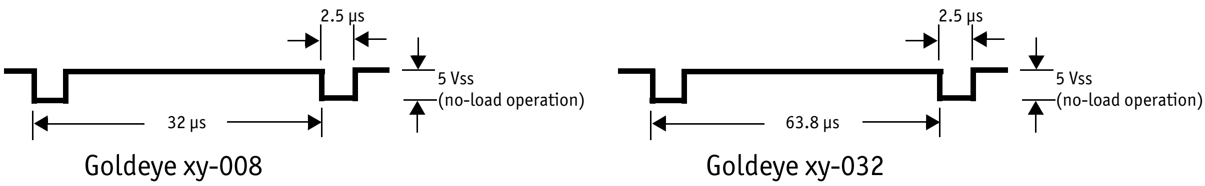


Figure 12: Line-sync output diagram

The line-sync output (active low) supplies approx. 900 mV at a termination with 75 ohms.

Frame-sync output (pin 15)

The frame-sync output is only active in continuous operation..

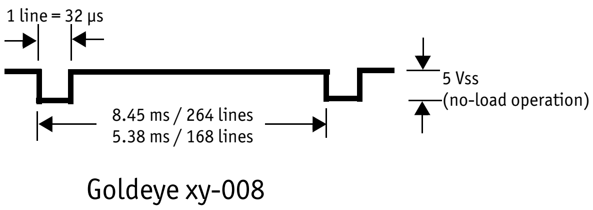


Figure 13: Frame-sync output diagram

The frame-sync output (active low) supplies approx. 900 mV at a termination with 75 Ω.

Data interface

The Goldeye xy-008/032 camera models are available in two different data interface versions, Camera Link Base and Gigabit Ethernet.

In the following paragraphs first the Camera Link interface is described. To better understand the Gigabit Ethernet version it is important to know that this camera internally uses Camera Link compatible signals.

The adaptation to Gigabit Ethernet is done by a third-party Camera Link frame grabber inside the camera. Thus, many of the attributes and features mentioned in conjunction with the Camera Link interface are also valid for the Gigabit Ethernet interface version.

Camera Link interface

Camera Link is an interface for the transfer of digital video data. The standard defines data transfer on a physical base and determines connectors, cables and components for transmission and reception. Three different configurations (base, medium and full) are available, distinguishing between the numbers of parallel transferred data bits. While the base configuration operates with one cable, for the medium and the full configuration two cables between camera and frame grabber are necessary.

The transmission components apply the **Channel Link** technology. 28 parallel data bits each are serialized in a ratio of 7:1 and transferred in connection with the clock signal via altogether five differential signal pairs. By using LVDS, net clock rates up to 85 MHz can be achieved and cable lengths up to 10 m are possible. Moreover four different control signals for camera control (CC1 – CC4) from the frame grabber to the camera are available as well as a bi-directional serial communication channel that is also designed differentially. The following drawing illustrates the Camera Link signals in the base configuration that is used in the Goldeye CL-008/032 models.

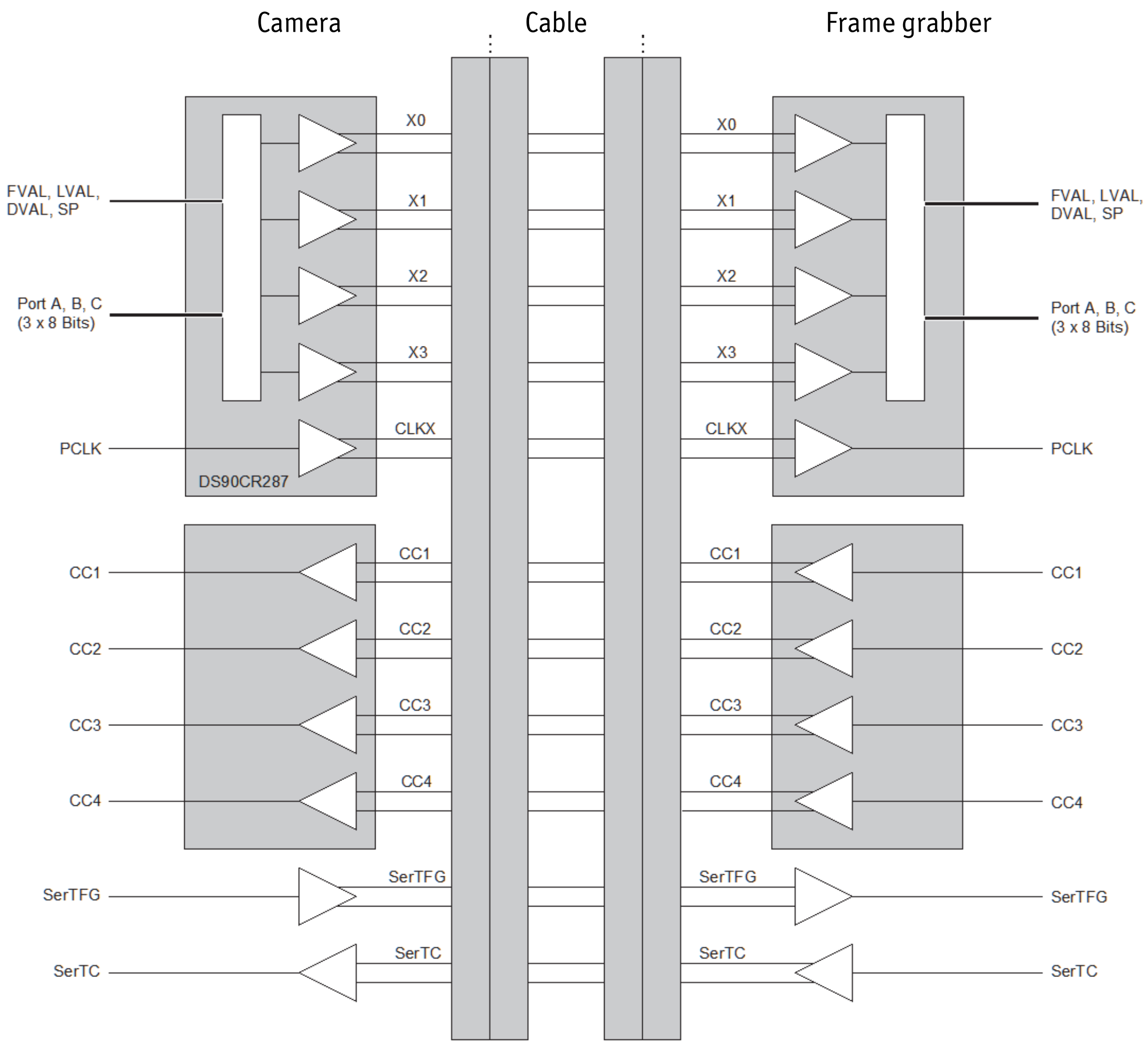


Figure 14: Camera Link signals in base configuration (Goldeye CL-...)

Pin assignment of Camera Link connector (base configuration)

Pin	Signal	Pin	Signal
1	GND	14	GND
2	X0-	15	X0+
3	X1-	16	X1+
4	X2-	17	X2+
5	XCLK-	18	XCLK+
6	X3-	19	X3+
7	SerTC+ P*	20	SerTC- P*
8	SerTFG- P*	21	SerTFG+ P*
9	CC1-	22	CC1+
10	CC2+	23	CC2-
11	CC3-	24	CC3+
12	CC4+	25	CC4-
13	GND	26	GND

Table 19: Pin assignment: Camera Link connector (base)

*: Instead of the serial interface over the Camera Link connection (SerTC, SerTFG) the serial interface can be used via the RS232 signals of the 15-pin D-sub connector alternatively. In this case an additional data cable is necessary.

Trigger input (CC1)

If the camera is in image-on-demand mode, the start of the exposure and the exposure time is controlled with this signal.

Note

Activating the image-on-demand mode is mandatory to enable exposure time control.

For more information: see Chapter *IOD mode (CC4)* on page 47.

As alternative trigger- and exposure control line the trigger input at pins 10 and 11 of the 15-pin D-sub connector is available. For more information: see Chapter *Trigger input (pin 10, 11)* on page 39. The two trigger sources are internally combined with an OR gate.

By activating the CC1 input signal, the active exposure of the sensor starts with and stays active as long as the CC1 input is active. The preset exposure time is always rounded to a multiple of the line time from 32 µs (Goldeye xy-008) or 63.4 µs (Goldeye xy-032).

The camera can be single triggered or periodically triggered with a fixed frame rate (t_p) up to the maximum frame rate of 118 fps (Goldeye xy-008) or 30 fps (Goldeye xy-032).

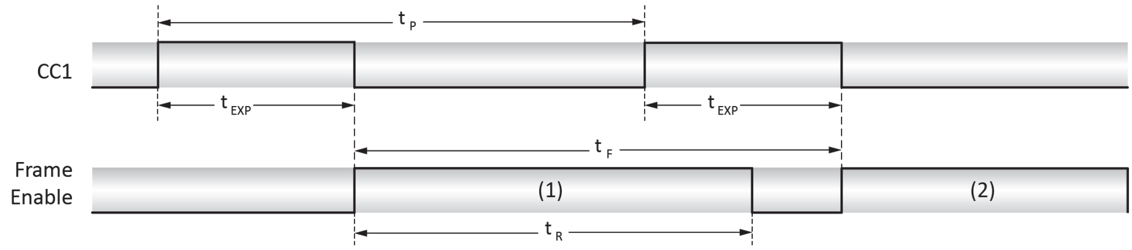


Figure 15: Trigger input diagram

Goldeye xy-008	Goldeye xy-032
t_P: Trigger period	t_P: Trigger period
t_{EXP}: Exposure time	t_{EXP}: Exposure time
t_R: Readout time	t_R: Readout time
t_R = 8.2 ms (320 x 256)	t_R = 32.4 ms
t_R = 5.1 ms (320 x 160)	
t_F: Frame period ($t_F = t_P$)	t_F: Frame period ($t_F = t_P$)
t_{Fc}: Frame period in continuous mode	t_{Fc}: Frame period in continuous mode
t_{Fc} = 8.45 ms (320 x 256)	t_{Fc} = 33.0 ms
t_{Fc} = 5.38 ms (320 x 160)	
$t_P \geq t_{Fc}$	$t_P \geq t_{Fc}$
$t_P - t_{EXP} > 64$ µs (Must be kept!)	$t_P - t_{EXP} > 574$ µs (Must be kept!)

Table 20: Trigger input values

Model	Goldeye xy-008	Goldeye xy-032
Max exposure delay	$t_{EXP} < t_P - t_R - 192$ µs: max. 5 µs else: max. 1 line (also for reduced resolution)	max. 5 µs
Max jitter	$t_{EXP} < t_P - t_R - 192$ µs: max. 1 pixel else: max. 1 line	max. 1 pixel

Table 21: Exposure delay and jitter

In the Goldeye P-variants the CC1 signal is directly controlled using GigE Vision features located in the AcquisitionControl branch of the feature tree.

Feature	Description
AcquisitionMode	This feature controls the acquisition mode of the software. This feature works independently (!) of the chosen camera mode (Continuous, IOD hardware trigger, IOD hardware timer). It describes how many frames should be acquired.
AcquisitionStart	Starts the image acquisition of the camera.
AcquisitionStop	Stops the image acquisition of the camera.
TriggerMode	Modifies the trigger mode of the camera. When the trigger mode is *Off*, the camera will generate frames independently. When the trigger mode is *On* the camera is switched to the so called IOD (Image On Demand) mode. In this mode the camera waits for an external trigger signal or timer pulse generated by the internal GigE interface. To control exposure and dark time trigger mode must be switched to *On*.
ExposureMode	Start or stop the internal exposure signal timer.
ExposureTime	Sets the Exposure time (in microseconds).
ExposureTimeAbs	Sets the Exposure time (in microseconds).
ExposureTimeGranularity	Exposure time granularity.
ExposureTimeAbsMs	Sets the Exposure time (in milliseconds).
DarkTime	Sets the Dark time (in microseconds).
DarkTimeAbs	Sets the Dark time (in microseconds).
DarkTimeGranularity	Dark time granularity.
DarkTimeAbsMs	Sets the Dark time (in milliseconds).

Table 22: Camera standard feature: AcquisitionControl

High-speed mode (CC2) Goldeye xy-008 only

If CC2 is logically 1, the camera works with a resolution of 320 x 256 pixels at 118 fps.

If CC2 is logically 0, the camera works with a reduced resolution of 320 x 160 pixels at 186 fps.

In both cases DVAL is set to 1 for one Camera Link clock cycle in each pixel cycle of two clocks.

The DVAL signal has to be evaluated by the frame grabber, otherwise the effective resolution is 640 x 256 pixels or rather 640 x 160 (each pixel is horizontally output for two times) independent of the CC2 state.

For more information about the DVAL signal and pixel multiplication background: see Chapter *Timing (FVAL, LVAL, DVAL, PCLK)* on page 48.

GigE feature name (CameraSpecialFeatures)	Feature visibility	Description
HighSpeedMode	Beginner	Turn on or off the high-speed mode with reduced resolution (320x256 @118 fps / 320x160 @186 fps)

Table 23: Camera special feature: High-speed mode

Gain (CC3)

With the camera control signal CC3 the camera gain can be switched. If CC3 is logically 1 the camera works with a gain value of one.

If the CC3 port is logically 0 the gain value is set to 10 (Goldeye xy-008) or 20 (Goldeye xy-032).

GigE feature name (AnalogControls)	Feature visibility	Description
Gain	Beginner	This feature controls the selected gain as a raw integer value.

Table 24: Camera special feature: Gain

IOD mode (CC4)

The camera control signal CC4 switches between the continuous free-running operation with fixed exposure time of 10 ms /5.4 ms (Goldeye xy-008) or 33.3 ms (Goldeye xy-032) on the one hand and the shutter- and image-on-demand operation on the other hand.

If CC4 is logically 0, the image-on-demand mode is set. The camera will output one image for every exposure impulse it receives via trigger input (CC1 or opto-coupler input).

If CC4 is logically 1, the camera operates in continuous mode. As a second input signal pin 9 of the 15 pin D-sub connector also controls the IOD mode. If one of these two inputs selects IOD mode, it overrides the continuous mode selection of the other one.

GigE feature name (AcquisitionControl)	Feature visibility	Description
TriggerMode	Beginner	Modifies the trigger mode of the camera. When the trigger mode is **Off**, the camera will generate frames independently. When the trigger mode is **On**, the camera is switched to the image-on-demand (IOD) mode. In this mode the camera waits for an external trigger signal or a timer pulse. To control the exposure and the dark time trigger, mode must be switched to **On**.

Table 25: Camera special feature: Trigger mode

Timing (FVAL, LVAL, DVAL, PCLK)

The Camera Link specification provides three synchronization signals:

- FVAL (Frame Valid) – HIGH during transmission of valid lines of an image.
- LVAL (Line Valid) – HIGH during transmission of valid pixels of a line.
- DVAL (Data Valid) – HIGH in the case valid pixel data are present.

The gross pixel rate at the InGaAs sensor is 10.5 MHz.

However, the maximum available bandwidth of the Camera Link Base configuration is not nearly exploited. The transmission components require a minimum clock frequency for a safe operation. For this reason, the internal clock frequency is artificially increased before being output as Camera Link clock signal.

As a consequence, an unnecessary high data rate would occur at the frame grabber, and, thus, a multiple of the essential data volume ought to be moved within the storage of the receiver. Now the DVAL signal offers the opportunity to explicitly mark particular data words as valid so that only the essential pixel data are stored in the frame grabber memory.

Note

To ensure that the frame grabber does not only evaluate the signals FVAL and LVAL, select a frame grabber (and developing software), that also supports DVAL.

The following diagrams illustrate these facts:

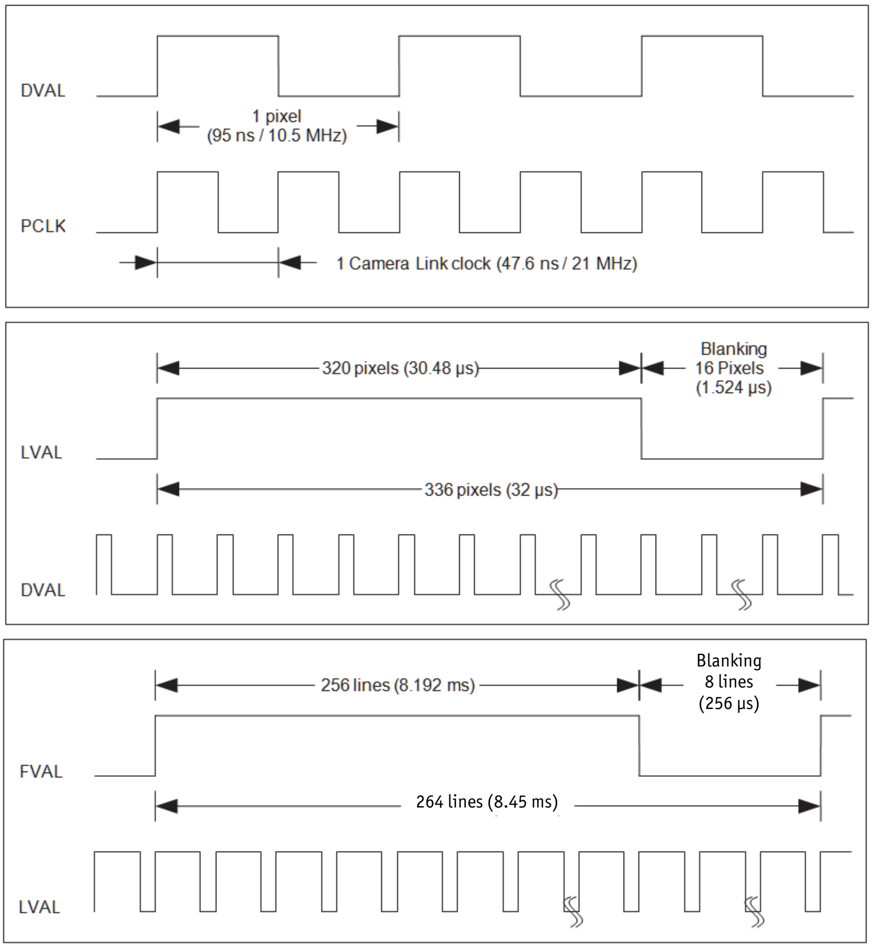


Figure 16: Timing diagram: Goldeye xy-008 (320x**256**)

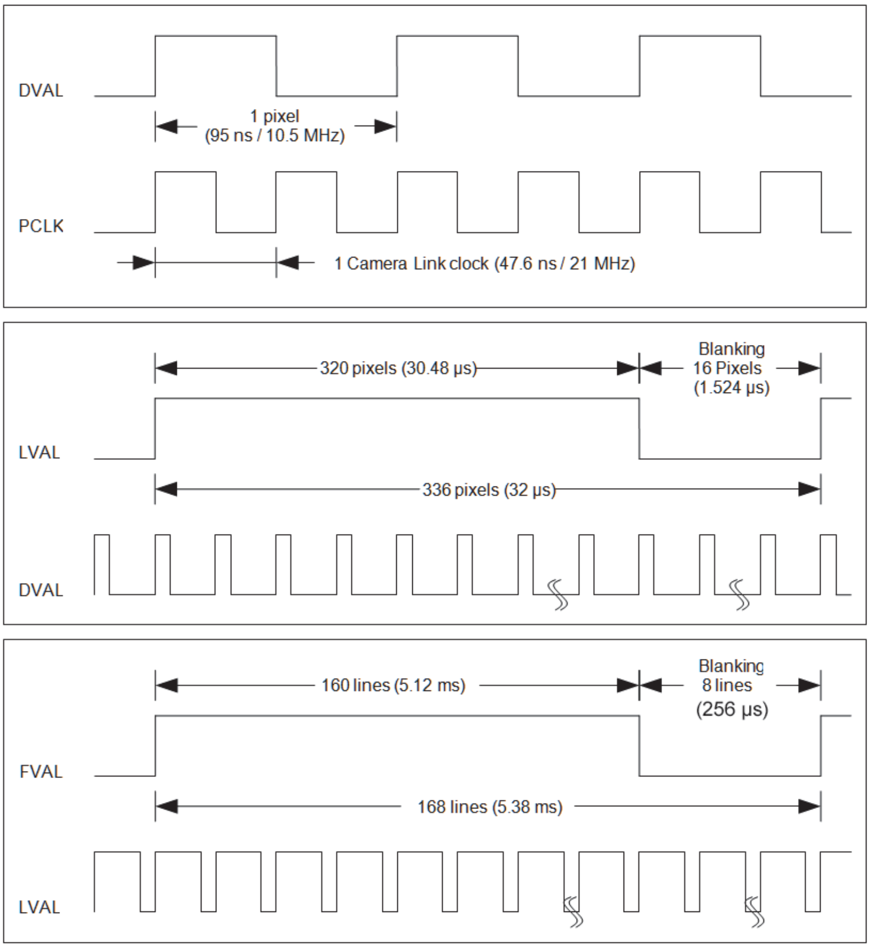


Figure 17: Timing diagram: Goldeye xy-008 (320x160)

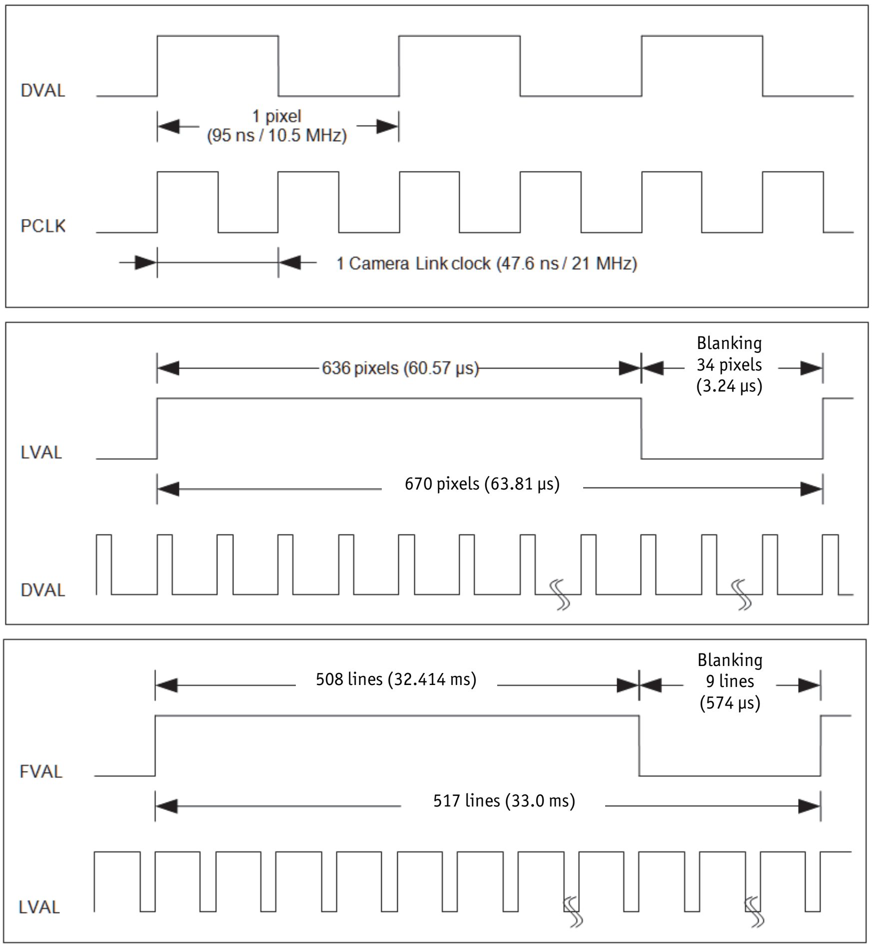


Figure 18: Timing diagram: Goldeye xy-032

Camera Link output data specification

The image pixel data is output as 12-bit values. A bit assignment for 12-bit grey values according to the Camera Link specification is used.

Camera Link Port	(1 x 12 Bit)
A0	D0 (LSB)
A1	D1
A2	D2
A3	D3
A4	D4
A5	D5
A6	D6
A7	D7
B0	D8
B1	D9
B2	D10
B3	D11 (MSB)
B4	
B5	
B6	
B7	
C0	
C1	
C2	
C3	
C4	
C5	
C6	
C7	

Table 26: Output data specification

GigE interface

The **Goldeye P-008/032** cameras are equipped with a 1000Base-T Ethernet interface (RJ45 (8P8C) connector). The data connection between the camera and PC can be established via a standard patch cable of category 5e or better.

Note

For more information see the **Pleora iPORT PT1000-VB Documentation**.

Pin assignment of the Gigabit Ethernet connector

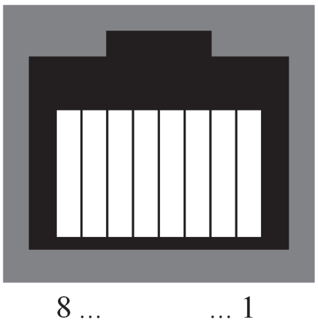


Figure 19: Front view of the Gigabit Ethernet connector

Pin	Signal
1	D1+
2	D1–
3	D2+
4	D3+
5	D3-
6	D2-
7	D4+
8	D4–

Table 27: GigE connector: pin assignment

Image processing

This chapter explains the function of the **Goldeye xy-...** firmware. It is related to the individual modules of image processing and shows how the user can control these modules via the serial interface.

Image processing chain

The **Goldeye xy-...** firmware has various correction modules that are combined in a chain. A module receives the source image data at the input, processes them and supplies at the output the modified data further to the next module. The following diagram shows the modules that are relevant in conjunction with the **Goldeye xy-...** camera.

Note

The firmware may contain other modules not shown in this drawing, but mentioned in the Chapter Command reference on page 76.

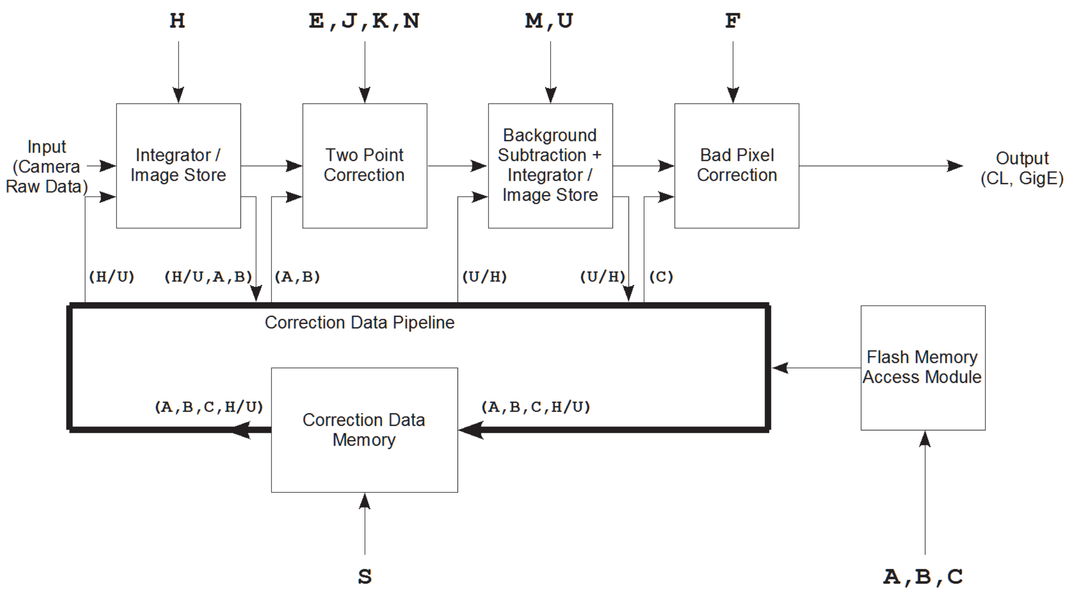


Figure 20: Data processing: **Goldeye xy-...**

Note

Each module can have various parameters that control the operation mode.

In the *Figure 20: Data processing: Goldeye xy-...* on page 54 and within the text of this manual, these parameters are always marked by **`Courier bold`** font in order to highlighting them to be parameters (or commands) adjustable via the serial interface.

For fast access, all available correction data (e.g. reference images for the two-point correction and bad pixel correction control data) are copied from the non-volatile flash memory onto a correction data memory (SDRAM) when starting the camera. From this point the correction data is sequentially shifted through the correction data pipeline. The image data from the camera head is shifted through the correction modules in parallel to the correction data. If a module needs correction data, it is fed from a tap in the correction data pipeline to the module. A module can also write back modified correction data to the pipeline.

The main correction modules are in detail:

- Two-point correction
- Background correction
- Bad pixel correction

Two-point correction

With help of the **two-point correction** (and also *gain offset correction*), the normally distinctive underground structure of the image sensor can be equalized. The gain and the offset for each pixel of the input image can be adapted to the set values on the basis of two reference images so that, in the optimum case, no image structure is discernible.

Background correction

With this module you can correct the live image with a previously recorded dark image. This image is subtracted from the two-point corrected image data to reduce the remaining fixed pattern noise.

Bad pixel correction

The **bad pixel correction** uses up to six non-false neighbor pixels to determine an interpolated value from the neighboring pixels that replaces the bad pixel. In this way, the image appears without disturbing **hot** or **cold** pixels.

Correction data

Ex factory camera specific correction data for each correction module are determined and stored in the camera so that an optimum image quality is available at the Camera Link or Gigabit Ethernet interface. A PC with a Camera Link frame grabber or Gigabit Ethernet interface can transmit the image data directly to the main memory or rather to the display.

Correction sets

Several different correction sets for the two-point correction are stored inside the camera to ensure high quality requirements. By transmitting commands over the serial interface the user is able to activate (manually or automatically) the correction set most suitable for the actual environment conditions of the camera.

File system

The **Goldeye xy-...** camera models are equipped with a non-volatile data memory (flash) that records configuration and correction data. The data is managed in a minimalist file system.

Due to the file system, the following restrictions exist:

- Files are identified via a single byte. In regard to its function, this file number is comparable to the file name (including extension) from the PC world. Valid file numbers are between 1 (0x01) and 254 (0xFE).
- The file type can be defined via a further byte. It is an optional clustering feature for files, but it has no relevance for the file identification.
- There is no directory structure. All files are on one single hierarchy level within the main directory. This results in a maximum possible number of 254 simultaneously stored files, because each file number can only be allocated once.

Ex factory the camera is usually already equipped with several files, containing system and correction data.

A survey of the available files with correction data and possibly accompanying parameters can be found in the individual correction data information, being separately delivered with each camera.

Short introduction: Two-point correction (A, B, E, J, K, N)

The two-point correction is the most elaborate correction module of the **Goldeye xy-...** camera models. For this reason initially a general survey of the two-point correction functioning shall be given.

Note

For more information see Chapter Basic parameters and commands on page 59.

This will probably be sufficient for most users, due to the fact that the determining and adjustment of nearly all parameters is already executed ex factory and normally, no user intervention is necessary at all.

For more extensive details of the current parameters see Chapter Advanced parameters and commands on page 63.

By means of the two-point correction (also called *gain offset correction*) usually, the distinctive underground structure of the **InGaAs** sensor can be equalized. The target is to transmit the individual characteristic curve of each pixel to a set characteristic curve, being valid for all pixels. In order to achieve this result, the effective characteristic curve of each single pixel is determined by taking up data samples. A linear characteristic curve is supposed so that two data samples are sufficient for a definite determination. By means of recording two reference images at the **light levels** T_A and T_B the data samples can be determined for all pixels. Furthermore, the digital set values J and K each belonging to the light levels T_A and T_B are determined.

Owing to the four parameters mentioned above, the two-point correction is now able to modify the gain and the offset of each pixel characteristic curve in a way that it is congruent with the set characteristic curve. Therefore, in an optimum **linear** case, an image structure, caused by the sensor, does no longer occur. The below mentioned diagram tries to exemplary explain the facts on the basis of one single pixel characteristic curve:

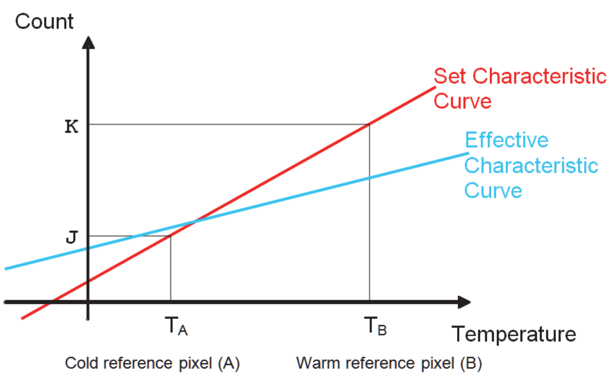


Figure 21: Two-point correction

The reference images are stored in several files within the flash and are directly transferred into the correction memory following the camera start-up. The parameter **`A`** indicates the file number of the correction image at low reference light level T_A. The parameter **`B`** serves the same purpose for the reference image at light level T_B.

For improvement of image quality the camera usually is delivered ex-factory with several sets of correction data that are determined for diverse operating conditions.

Diverse correction images (**`A`**, **`B`**) may exist including the according set values (**`J`**, **`K`**). These correction images are loaded to the correction memory during the camera start-up.

Basic parameters and commands

This chapter illustrates the basic configuration options and general commands available for the user, being important for the operation of an ex factory pre-configured camera. Most probably the information stated here will be sufficient for most of the users.

Note

For more information see Chapter Advanced parameters and commands on page 63.

Automatic correction data set selection (k)

You can use this automatic data set selection / calibration (one-time or timer controlled repeating) to do an automatic correction on your data. The automatic process tries to determine the best data set `S` (if several available) and activates it.

Criterion for the data set selection is a statistics value that is correlating with the fixed pattern noise (vertical stripe structure), being visible within the image. For the determination of this statistics value an image is recorded and stored by means of the first *Integrator / Image Memory* module in the chain. This acquired image is tested in succession with each correction set being available in the memory by determining the statistics value of the corrected data. Finally that memory page `S` becomes activated, which is showing the best results for the statistics value.

Depending on the number of available data sets the automatic data sets and the current frame rate the automatic data set selection can take some seconds. During the data set selection, the image output is stopped by suppression of the FVAL signal. This procedure needs images from the camera. This means that either Continuous Mode or Image On Demand Mode with a periodic trigger signal must be active. According to each image content, under the same conditions diverse correction sets can be chosen if they are very similar to one another. Usually, the automatic data set selection activates a good correction data set but not always the best possible one. Use the command `S` instead of `k` to manually adjust the correction data set number. Depending on the camera model and current `j` parameter configuration, the actions accomplished by the `k` command and its output at the serial interface may vary.

Note

For more information on the corresponding commands see Chapter Command reference on page 76.

Example

Start the correction data selection once and activate the best data set based on the internal statistics value.

>**k=0 [CR]**

S=0A

>

Goldeye xy-008 If **k** is not set to 0 the automatic search starts at approx. each **k** * 256 images. At a frame rate of e.g. 50 images per second the chronological resolution of the **k** value is approx. 5.1 seconds.

Goldeye xy-032 If **k** is not set to 0 the automatic search starts at approx. each **k** * 256 images. At a frame rate of e.g. 30 images per second the chronological resolution of the **k** value is approx. 8.53 seconds.

Example

Goldeye xy-008 The automatic correction data selection shall always be started approx. every 1200 seconds (20 minutes): 1200 s / 5.1 s per count ≈ 235 = 0xEB.

Goldeye xy-032 The automatic correction data selection shall always be started approx. every 1200 seconds (20 minutes): 1200 s / 8.53 s per count ≈ 140 = 0x8C.

>**k=EB [CR]** (example Goldeye xy-008)

S=0A(...at once)

>S=0B(...after each 235 * 256 images...)

(...)

GigE feature name (CameraSpecialFeatures)	Feature Visibility	Description
AutoCalibrateOnce	Beginner	Start the automatic calibration once. (k=0 command) The processing of this command can take several seconds, depending on the current frame rate and the number of correction data sets available.

Table 28: GigE feature: AutoCalibrateOnce

Select a correction data set (S)

All **Goldeye xy-...** cameras are equipped with multiple correction data sets for different operation conditions. The image quality can be improved by activating another correction data set if the environmental conditions have changed.

For a quick access to the different correction data sets, the correction data memory is subdivided into 32 single pages. Each of these pages can store a complete set of correction data (parameters **A** and **B**). At all times only one page can be active simultaneously and all eventual modification of the correction data takes place within this page. For each correction memory page a further pair of registers for the parameters **J** and **K** is available. To enable an access on the values **J** and **K** of each correction data set, the page address also serves as access address to the register pairs.

The memory pages are filled with data starting at the address 0. The highest valid address depends on the number of correction data sets stored in the camera, however it can not exceed 31 (0x1F). If e.g. 27 correction data sets are available this results in a maximum valid page address of 0x1A.

Both parameters, **`A`** and **`B`** together, affect the choice and the number of data sets to be loaded.

By means of the parameter **`S`** the address of the active page can be adjusted:

Example

Activate the eleventh correction data set (address 10 = 0xA)

>**`S=A[CR]`**

GigE feature name (CameraSpecialFeatures)	Feature Visibility	Description
CorrectionDataSet	Beginner	Number of the correction data set to activate. (S=<value> command)

Table 29: GigE feature: CorrectionDataSet

Temperature warning (T)

The command **`T=1`** displays the content of the temperature warning register. The lowest order bit has the same function as LED L3 placed at the backside of the camera housing. If the value 1 is output, the temperature of the InGaAs sensor is outside the optimum range.

When you switch on the cold camera, wait some minutes. The sensor temperature needs this time to stabilize to the set value.

If the temperature warning remains active for a longer period, check the ambient temperature of the camera.

GigE feature name (CameraSpecialFeatures)	Feature visibility	Description
SensorTemperatureState	Expert	Camera sensor temperature state. 0 = The sensor temperature is OK. 1 = The sensor temperature is outside the optimum range.
SensorTemperatureStateReg	Expert	Camera sensor temperature state register.
QuerySensorTemperatureState	Beginner	Query camera sensor temperature state. (T=1 command)

Table 30: GigE feature: Camera sensor temperature

Software version and correction data information (V)

The command `V=1` shows information of the correction data installed in the non-volatile memory. The current firmware version and also the serial number of the camera are output.

Note

This function is not available as GigE Vision feature.

Current parameter settings (Y)

The command `Y=1` shows the actual set parameter values.

Note

This function is not available as GigE Vision feature.

Show help text (?)

The command **?=1** shows a command reference text at the serial terminal. It lists a short description for each command available in the firmware.

Note

This function is not available as GigE Vision feature.

Note

The displayed command reference is for both: AVT Goldeye and AVT Pearleye camera families.

See the command reference to verify, if a command is valid for your camera model: Chapter Command reference on page 76.

Advanced parameters and commands

This chapter illustrates the advanced configuration of the **Goldeye xy-...** models.

Note

In most cases, the use of basic commands is sufficient.

In some cases you might need the following advanced parameters and commands.

Two-point correction (A, B, E, J, K, N)

To configure the two-point correction, use the following parameters:

Parameter	Description
A	File number of the first correction image recorded at **low** reference temperature
B	File number of the first correction image recorded at **high** reference temperature
E	Two-point correction operating mode
J	Set value of the correction image of the actual chosen correction data set recorded at **low** reference
K	Set value of the correction image of the actual chosen correction data set recorded at **high** reference
N	File number for the set values of all correction data sets

Table 31: Advanced parameters: two-point correction

The parameter **E** controls the operation mode of the two-point correction. The following value assignments are valid:

Value	Description
0	Deactivated Data are passed through transparently.
1	Activated Correction data **A** and **B** are used, with the set values **J** and **K** of the actual correction memory page **S**.
2	Deactivated Test mode: Correction data **A** are output as image data. (*)
3	Deactivated Test mode: Correction data **B** are output as image data. (*)

Table 32: Parameter **E**: values

Value	Description
4	One-point correction: Simple subtraction of the correction data **A** from the input data. In addition, the set value **`J`** is added as offset to each pixel value.
5	One-point correction: Simple subtraction of the correction data **`B`** from the input data. In addition, the set value **`K`** is added as offset to each pixel value.

Table 32: Parameter **`E`**: values

Note

(*) Test modes 2 and 3 are for test purposes.

If you activate mode 2 or 3, the module does not transmit any incoming image data. The module outputs correction data as image data only.

Example

Activate the two-point correction

`>E=1[CR]`

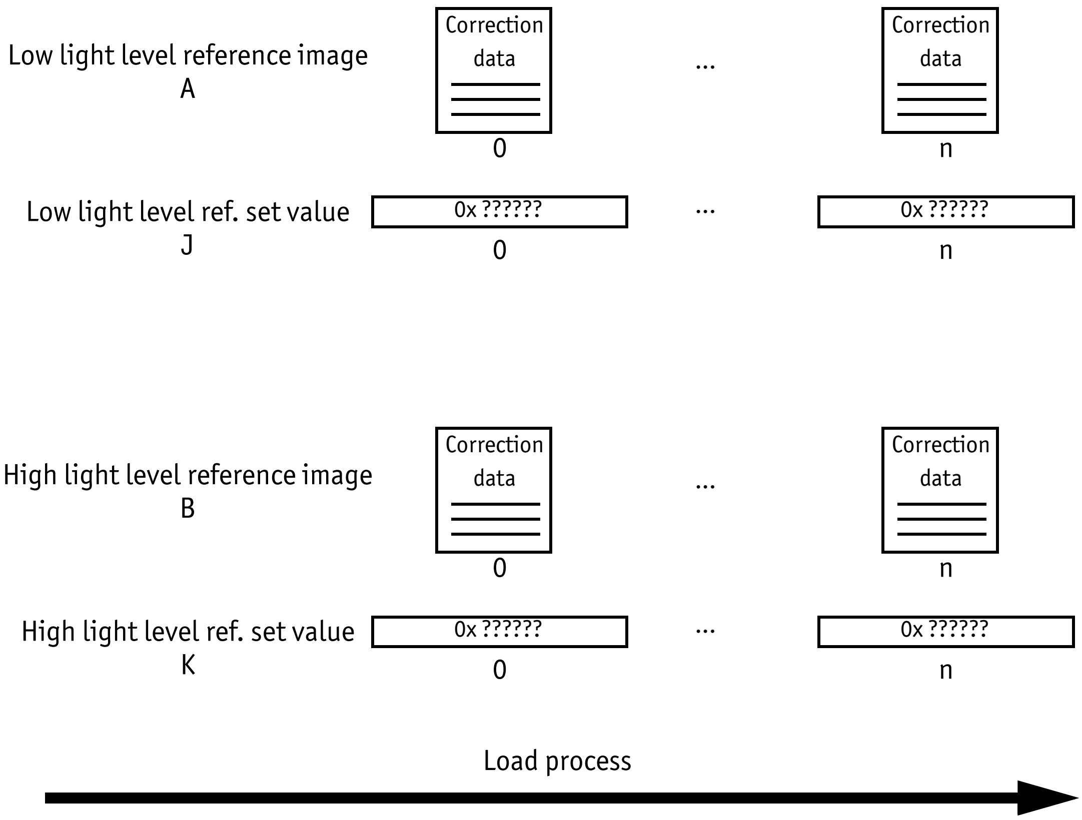


Figure 22: Schematic process of two-point correction

The parameters **A** and **B** define both files out of which the reference images for the two-point correction data are loaded. If various correction data sets are available, each of the reference images in the file system is stored in a closed sequence of file numbers. The loading process following the camera start begins at the first cold (low) reference image **A**. Then the loading process continues with the accompanying warm (high) reference image **B**.

In the following step an attempt is made to load the file numbers **A+1**, then **B+1**, and so on. This process continues as long as one file number is missing within the file system or the maximum number of correction sets (actually 32) is achieved.

If, during operation, the value of **A** or **B** is new adjusted, this change causes the immediate data load out of this file. Different to the automatic loading procedure following the switch-on of the camera, the data are exclusively copied within the memory page **S** therefore being activated (see Chapter *Select a correction data set (S)* on page 60).

After the non-volatile storage (**X=1**) and a restart of the camera, all file numbers following **A** and **B** are loaded into the correction data memory as mentioned above. For an optimum image quality, consider that the parameters **A** and **B** will always specify *a pair of two mating reference images*, even though these parameters are alterable separately.

Note

For more information on command X=1 see Chapter *Save parameters into flash (X)* on page 75.

Example

Loading of correction data at low reference temperature into the active correction memory page of file number 0x20.

>A=20[CR]

The set values for both reference images **A** and **B** are adjusted with the parameters **J** and **K**. For each correction data set, two registers are available. These include the corresponding set value. One always refers to both set values of the actual correction data set **S**.

If various correction sets are selectable, the set values are factory-bunched in one file, by the parameter **N**. If **N** is not zero, the values for all correction sets from this file are loaded, when switching-on the camera and restored with **X=1**.

If only one correction data set is available, **N** can remain zero, because **J** and **K** (only the values of the actual memory page) are stored together with all other parameters of one system file, apart from the file N.

Example

All set values of the two-point correction have to be loaded from the file 0x60.

>N=60[CR]

Generally, no changes at the set values have to be executed.

From the registers **J** and **K**, only the higher 12 bits are used.

The lower 4 bits are reserved for prospective extensions and should always be set to zero:

Bit position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value (12-bit)	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	-	-	-	-
	x												**0**			

Table 33: J and K: bit usage

Example

The digital set value for the dark reference image is x = 410 = 0x19A.

`>J=19A0[CR]`

GigE Feature Name	Feature Visibility	Description
TPC_OperationMode	Expert	Operation mode of the two-point correction. (E=<value> command)
TPC_CorrectionData_FileNumber	Expert	File number of the flash file containing the set values for the two-point correction. (N=<value> command)
TPC_SetValue_LowRef	Expert	Define the set value for the low reference image of the two-point correction. (J=<value> command)
TPC_SetValue_HighRef	Expert	Define the set value for the high reference image of the two-point correction. (K=<value> command)
TPC_FirstImage_LowRef	Expert	File number of the first low reference image of the two-point correction. (A=<value> command)
TPC_FirstImage_HighRef	Expert	File number of the first high reference image of the two-point correction. (B=<value> command)

Table 34: GigE feature: TwoPointCorrection (TPC)

Recording of temporary reference images (A, B, J, K)

For an optimal image quality both reference images of the two-point correction may temporarily be replaced by newly recorded ones within the actual correction memory page **S**. For recording one requires a reference area with a spatially constant brightness. The reference area is placed in front of the camera filling the complete image and being out of focus of the lens. By assignment of

a special value to parameter **A**, the recording of a low (dark) reference image can be started now, or when assigning to parameter **B** the recording of a high (light) reference image.

Example

New recording of a low reference image of the two-point correction within actual correction memory page **S**.

>**A=FF[CR]**

In this case, the special parameter value **FF** is not a file number, but starts an integration of 64 single images and transfers the result into the correction storage. The initially adjusted file number remains unchanged.

After acquisition of new reference images, the set values **J** (or **K**) should be adjusted to the mean value of the corresponding reference image to reduce a gain or offset leap when switching between different correction data sets.

In order to stop the influence on the correction result of each other reference image following the new recording of only a single reference image, the two point correction can be operated via **E=4** or **E=5** as a simple one-point correction (background correction).

The newly recorded reference images are kept within the volatile correction data storage (SDRAM) and will be lost when switching off the camera.

GigE Feature Name	Feature Visibility	Description
TPC_SetValue_LowRef	Expert	Define the set value for the low reference image of the two-point correction. (J=<value> command)
TPC_SetValue_HighRef	Expert	Define the set value for the high reference image of the two-point correction. (K=<value> command)
TPC_FirstImage_LowRef	Expert	File number of the first low reference image of the two-point correction. (A=<value> command)
TPC_FirstImage_HighRef	Expert	File number of the first high reference image of the two-point correction. (B=<value> command)

Table 35: GigE feature: TwoPointCorrection (TPC)

Background correction (U, M)

The module **background correction** is closely related to the module **integrator / image store** at the beginning of the processing chain (**H**). It also comprehends an image integration function. Additionally it can subtract its current correction data image (**H**/**U**) from the incoming image and add the offset **M**. Thus a fixed pattern noise reduction or difference image calculation is possible.

The bits of the parameter value are divided into three different sized bit groups **a**, **b** and **c**. Each bit group has a special function, being independent of the other ones:

- **a**: Controls the output of background correction module. Besides the normal background correction mode, the actual memory content (`H`/`U`) of the integrator can also be output. In this case the correction module becomes an image source itself. It provides a simple image storage function.

Note

The bit group **a** is split into two separate areas (see the table below).

- **b**: Defines the number of images to be integrated and starts the integration process as soon as a new value is set.
- **c**: Indicates whether the last started integration is still running. This bit can only be read out; during write access to `U`, it is ignored.

The table below illustrates the possible values for the individual bit groups:

<table>
<tr><td rowspan="16">U</td><td rowspan="16">0</td><td colspan="2" rowspan="3">Operation Mode
Background Correction</td><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>c</td><td>-</td><td>-</td><td>a</td><td>b</td><td>b</td><td>b</td><td>a</td></tr>
<tr><td colspan="4"></td><td colspan="4"></td><td>ro</td><td></td><td></td><td>rw</td><td>rw</td><td>rw</td><td>rw</td><td>rw</td></tr>
<tr><td>Bit group</td><td>Value (hex)</td><td colspan="16">Explanation</td></tr>
<tr><td rowspan="3">a</td><td>0</td><td colspan="16">Output: deactivated. Data are passed through transparently.</td></tr>
<tr><td>1</td><td colspan="16">Output: activated. Apply the current correction image (H/U) and offset value M.</td></tr>
<tr><td>2</td><td colspan="16">Output: activated. Output of current correction image (H/U).</td></tr>
<tr><td rowspan="6">b</td><td>0</td><td colspan="16">Integration: deactivated. The image storage content is not changed.</td></tr>
<tr><td>1</td><td colspan="16">Integration: 1 image. The following image is copied into the image storage.</td></tr>
<tr><td>4</td><td colspan="16">Integration: 8 images. The following 8 images are integrated and the result is copied into the image storage.</td></tr>
<tr><td>5</td><td colspan="16">Integration: 16 images. The following 16 images are integrated and the result is copied into the image storage.</td></tr>
<tr><td>6</td><td colspan="16">Integration: 32 images. The following 32 images are integrated and the result is copied into the image storage.</td></tr>
<tr><td>7</td><td colspan="16">Integration: 64 images. The following 64 images are integrated and the result is copied into the image storage.</td></tr>
<tr><td rowspan="2">c</td><td>0</td><td colspan="16">Integration completed. (This value can only be read out.)</td></tr>
<tr><td>1</td><td colspan="16">Integration still running. (This value can only be read out.)</td></tr>
<tr><td colspan="18">Note: The Integration is activated by change of the bit group b of <code>U</code>.
Example: If a further integration of 64 images is subject to be started, directly following the integration of 64 images, another value has to be written into the register first.
Example: <code>U=E</code>, <code>U=0</code>, <code>U=E</code>.</td></tr>
</table>

Table 36: Parameter U: values

Example

Integration of 32 images simultaneously to the output of the actual integration image (a=2, b=6) => abbba = 11100 [binary] = 0x1A. After that, reactivate the background correction.

Command sequence

>**U=1A[CR]**

...wait for at least 34 image cycles (32 + 2 frames jitter buffer, 0.85 seconds at 40 images / second) or poll the state of bit group c with **Y=1**...

>**U=1[CR]**

The parameter **M** defines the offset value that is added to each pixel if the background correction is activated. By default, **M** is automatically set to the mean value of the background image, provided that the background image acquisition is done with the automatic calibration function (**k**).

In this way it is possible to preserve the constant component of the image irrespective of the background correction's activation state. Integrating a new background correction image with the command **U** does *not* modify **M**. Only the 12 most significant bits of this 16-bit value are relevant.

The following table reveals the bit order:

Bit position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value (12-bit)	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	-	-	-	-
	a												**0**			

Table 37: U and M: bit usage

Example

Set the background correction offset to 291 = 0x123

>**M=1230[CR]**

GigE Feature Name	Feature Visibility	Description
BGC_OperationMode	Expert	Operation mode of the background correction. (U=<value> command) While reading this feature the MSB shows the state of the integration process. (0=Idle, 1=Busy)
BGC_OffsetValue	Expert	Offset value for the background correction. (M=<value> command)

Table 38: GigE feature: BackgroundCorrection (BGC)

Bad pixel correction (C, F)

The configuration of the **bad pixel correction** is executed ex factory, therefore no access by the user is necessary.

The bad pixel correction applies up to six non-false neighbor pixels, in order to determine an interpolated value from the neighbors. At the position of the bad pixel an interpolated value in exchange of the bad pixel value is output.

The parameter **F** controls the operation mode of the bad pixel correction.

The following value assignment is applied:

Value	Description
0	Bad pixel correction deactivated; output of the uncorrected data.
1	Bad pixel correction is applied.
2	Testing mode, output of correction data. (*)

Table 39: Parameter F: values

Note

(*) Operation mode **2** exists for test purposes.

If you activate this mode, the module does not transmit any incoming image data. The module is a data source itself instead.

Example

Activate the bad pixel correction.

>**F=1 [CR]**

By means of parameter **C** the file number of the required correction data is indicated. Ex factory the bad pixels are determined one time and the corresponding correction data is stored in a special data format in the camera. As only one file with correction data generally exists in the camera, it is not necessary to change this parameter.

Example

Initialization of the correction data for the bad pixel correction from the file 0x70.

>**C=70 [CR]**

GigE Feature Name	Feature Visibility	Description
BPC_OperationMode	Expert	Operation mode of the bad pixel correction (F=<value> command)
BPC_CorrectionData_FileNumber	Expert	File number of the correction data for the bad pixel correction. (C=<value> command)

Table 40: GigE feature: Bad pixel correction (BPC)

Integrator and image store (H)

The **integrator / image store** module is internally applied for the automatic selection of the correction set (**`k=`**) and the recording of new temporary reference image data (**`A=FF`**, **`B=FF`**). Furthermore this module may also be controlled manually. The data are stored in the volatile SDRAM memory. They are lost after the camera is switched off.

The bits of the parameter value are divided into four different sized bit groups **a**, **b**, **c** and **d**. Each bit group has a special function, being independent of the other ones:

- **a**: Controls the output of integrator module. Either the incoming data are passed through transparently or the actual memory content of the integrator is output. In the latter case, the integrator becomes an image source itself. In this way, this module has a simple image storage function.
- **b**: Defines the number of images to be integrated and starts the integration process as soon as a new value is set.
- **c**: Controls the data copy mode. The image storage content of the integrator is copied into the correction data storage as low or high reference image of the two-point correction (parameter **`A`** or **`B`** in the active memory page **`S`**) at any time. The data copy mode should stay active for a minimum period of two complete image cycles in order to guarantee a save data transmission into the target area.
- **d**: Indicates whether the last started integration is still running. This bit can only be read out; during write access to **`H`**, it is ignored.

The table below illustrates the possible values for the individual bit groups:

			F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
H	0	**Operation Mode Integrator/Image Store**	-	-	-	-	-	-	-	-	d	-	c	c	b	b	b	a
											ro		rw	rw	rw	rw	rw	rw

Bit group	Value (hex)	Description
a	0	Output: deactivated. Data are passed through transparently.
	1	Output: activated. Output of actual image storage content.
b	0	Integration: deactivated. The image storage content is not changed.
	1	Integration: 1 image. The following image is copied into the image storage.
	4	Integration: 8 images. The following 8 images are integrated and the result is copied into the image storage.
	5	Integration: 16 images. The following 16 images are integrated and the result is copied into the image storage.
	6	Integration: 32 images. The following 32 images are integrated and the result is copied into the image storage.
	7	Integration: 64 images. The following 64 images are integrated and the result is copied into the image storage.
c	0	Copy: deactivated.
	1	Copy: Target A. The image storage content of the integrator is copied into the correction data storage as low reference image of the two point correction
	2	Copy: Target B. The image storage content of the integrator is copied into the correction data storage as high reference image of the two point correction
d	0	Integration completed. (This value can only be read out.)
	1	Integration still running. (This value can only be read out.)

Note: The Integration is activated by *change* of the register content of bit group x of **H**. If e.g. directly following the integration of 64 images a further integration of 64 images is started, another value has to be written into the register first.

Example: **H=E**, **H=0**, **H=E**.

Table 41: Integrator and image store: values

Example

Integration of 32 images simultaneously to the output of the actual integration image and copy as a reference image **A** into the correction data memory (c=1, b=6, a=1) => ccbbba = *011101* [binary] = 0x1D. As soon as the integration is terminated, you have to wait for at least two image cycles, before the copy procedure is finished.

>**H=1D [CR]**

...wait for at least 36 image cycles (34 + 2 frames jitter buffer, 0.9 seconds at 40 images / sec.) or poll the state of bit group **d** with **Y=1**...

>**H=0 [CR]**

GigE Feature Name	Feature Visibility	Description
IIS_OperationMode	Expert	Operation mode of the integrator and image store. (H=<value> command) While reading this feature the MSB shows the state of the integration process (0=Idle, 1=Busy)

Table 42: GigE feature: Integrator and image store (IIS)

Baud rate (s)

Caution

Do not change the baud rate, if you control the camera via GigE Vision features.

The baud rate of the RS232 interface is determined by use of register **s**:

The bits of the parameter value are divided into three different sized bit groups **a**, **e** and **x**. Each bit group has a special function, being independent of the other ones:

- **a**: Controls the configuration of the serial port.
- **e**: Controls the echo mode.
- **x**: Controls the baud rate of the serial port.

<table>
<tr><td rowspan="17">s</td><td rowspan="17">2A</td><td colspan="2" rowspan="3">Baud rate</td><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>e</td><td>a</td><td>a</td><td>-</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td colspan="4"></td><td colspan="4"></td><td>rw</td><td>rw</td><td>rw</td><td></td><td>rw</td><td>rw</td><td>rw</td><td>rw</td></tr>
<tr><td>Bit group</td><td>Value (hex)</td><td colspan="16">Description</td></tr>
<tr><td rowspan="11">x</td><td>0</td><td colspan="16">110 Baud</td></tr>
<tr><td>1</td><td colspan="16">300 Baud</td></tr>
<tr><td>2</td><td colspan="16">600 Baud</td></tr>
<tr><td>3</td><td colspan="16">1200 Baud</td></tr>
<tr><td>4</td><td colspan="16">2400 Baud</td></tr>
<tr><td>5</td><td colspan="16">4800 Baud</td></tr>
<tr><td>6</td><td colspan="16">9600 Baud</td></tr>
<tr><td>7</td><td colspan="16">19200 Baud</td></tr>
<tr><td>8</td><td colspan="16">38400 Baud</td></tr>
<tr><td>9</td><td colspan="16">57600 Baud</td></tr>
<tr><td>A</td><td colspan="16">115200 Baud</td></tr>
<tr><td rowspan="4">a</td><td>00</td><td colspan="16">RS232 via 15 pin SUB-D only</td></tr>
<tr><td>01</td><td colspan="16">Frame grabber serial port (Camera Link or Pleora device port serial IO)</td></tr>
<tr><td></td><td></td><td>10</td><td colspan="16">Additionally activate second channel via Pleora device port bulk 0 (MODE:UART) GigE interface only</td></tr>
<tr><td></td><td></td><td>11</td><td colspan="16">Reserved</td></tr>
<tr><td></td><td></td><td rowspan="2">e</td><td>0</td><td colspan="16">Each character received from the host is echoed back to it</td></tr>
<tr><td></td><td></td><td>1</td><td colspan="16">No Echo</td></tr>
</table>

Table 43: Baud rates: values

Example

Set the factory default (115200 Baud and activate serial interface via Camera Link / Gigabit Ethernet).

`>s=2A[CR]`

Note

This function is not available as GigE Vision feature.

Save parameters into flash (X)

Command **`X=1`** stores all parameter values into a system file within the flash memory. After a restart of the camera they are automatically restored. However, neither newly recorded correction images, nor modified set values (**`J`** and **`K`** for all valid **`S`**) are stored and will therefore be lost after the camera is switched off.

GigE Feature Name	Feature Visibility	Description
SaveParameterToCameraFlash	Expert	Stores all parameter values into a system file within the camera's flash memory. (X=<value> command)

Table 44: GigE feature: Save parameters into flash

Appendix

Command reference

This chapter describes the general command reference of the **Goldeye xy-...** firmware. It can be output to the camera's serial interface by sending the command **?=1**.

Note

The displayed command reference is for both: AVT Goldeye and AVT Pearleye camera families.

See this command reference to verify, if a command is valid for your camera model.

```
IRC-300CL/GE, IRC-320CL/GE, IRC-340CL/GE, IRC-600CL/GE, IRC-640CL/GE,
              NIR-300(F)(P)CL/GE, NIR-600PCL/PGE, NIR-610PCL/PGE;
                   Pearleye P-007 LWIR, Pearleye P-030 LWIR,
         Goldeye (CL/P)-008 SWIR (Cool) and Goldeye (CL/P)-032 SWIR Cool
                              Series Command Help
===============================================================================
Version...............: Vxx / xx.xx.20xx / AVT GmbH
Referenced Firmware...: Vxx / Vxxxx


General Information
-------------------

Each command consists of a command letter, optionally followed by an equality
sign and a parameter value in hexadecimal number representation. The command
letter is case sensitive. Hexadecimal values are always upper case and are 1 to
4 digits long. The command is activated by sending a carriage return character
([CR], ASCII character number 0x0D). Serial communication operates in echo mode
by default. This means that each character received by the module is echoed
back to the sender.

Example (set Baudrate to 115200 Baud, RS-232 only):
s=A[CR]

After successful execution of the command, the command input character ">" is
output. If any error occurred, somewhere previous to the prompt a question
mark character "?" is displayed.

To query a parameter value, send the corresponding command letter followed by
the equality sign and a question mark character:
s=?[CR]

If the intended action does not need any parameter, it is also sufficient in
most cases - as a shortcut - to send the command letter only, directly followed
by [CR].
```

```
At the beginning of a command sequence it is good practice to check the serial
communication by sending just a [CR] to the camera and verify that the command
prompt ">" is returned. There is an input buffer holding a few characters
but no hardware handshake. Thus a sequence of commands should not be send to
the camera without awaiting the intermediate input prompts. Otherwise the
camera's serial input buffer may overflow.


How to use Help
---------------

To see this help text type the following command:
?=1[CR]


Conventions
-----------

<p8>         : 8 bits long parameter value (1 to 2 Hex characters)
<p16>        : 16 bits long parameter value (1 to 4 Hex characters)
<aa00_*bbb>  : 8 bits long parameter (resulting in two hex chars)
               consisting of bit fields. The function of each bit field is
               described, like this:
                 "aa"    : Lower case letters label the bits of interest.
                 "00"    : These bits have to be zero.
                 "_"     : Separation character for readability.
                 "*"     : Marks a don´t care bit, should be written as "0".
                 "bbb"   : Bit fields may have any length.
(*)          : Some commands are only accessible in a special password protected
               administrator mode.


Command Overview (Lower Case Commands, Mainly for Administration purposes)
-----------------------------------------------------------------------------

a=<p16>          : Set the serial number A and save it to flash. (*)

b=<p16>          : Set the serial number B and save it to flash. (*)

c=<p8>           : Configure the FPGA with data from the specified file
                   number. (*)

d=<p8>           : Delete the file with the specified file number.

e=<p8>           : Erase the flash. (*)
                     e=0         : Erase used blocks only.
                     e=FF        : Erase all blocks.

f=<p16>          : Write a data byte to a FPGA register. (*)
                     High Byte   : Data value to write.
                     Low Byte    : Address of the register.

g=<p8>           : Read a data byte from a FPGA register at specified
                   address. (*)
```

```
h=<p16>         : Internal mode and control register. (*)
                  <**kk_jjih_gfed_cbaa>
                     \| \||| |||| ||\|
                      |  ||| |||| || +-a: Camera Link output mode.
                      |  ||| |||| ||      00 -> 12 data bits per pixel.
                      |  ||| |||| ||      01 -> 14 data bits per pixel.
                      |  ||| |||| ||      10 -> 16 data bits per pixel.
                      |  ||| |||| ||      11 -> 10 data bits per pixel.
                      |  ||| |||| |+---b: Destination of external trigger
                      |  ||| |||| |       signal (GE interface only). See
                      |  ||| |||| |       W=<p8> for details.
                      |  ||| |||| +----c: Current shutter state. Use I=<p8> to
                      |  ||| ||||         control the shutter (IRC-320/IRC-600,
                      |  ||| ||||         Pearleye P-007/P-030 only).
                      |  ||| |||+------d: NIR-300F/NIR-600 and Goldeye CL-008/
                      |  ||| |||          P-008/P-032 support.
                      |  ||| |||          0 -> Normal mode (e.g. for
                      |  ||| |||               IRC-300/320/600, NIR-300,
                      |  ||| |||               Pearleye P-007/030).
                      |  ||| |||          1 -> NIR-300F/NIR-600, Goldeye
                      |  ||| |||               CL-008/P-008/P-032 mode.
                      |  ||| ||+-------e: Destination for bad pixel correction
                      |  ||| ||           data loading from flash (NIR-300F,
                      |  ||| ||           Goldeye CL-008/P-008).
                      |  ||| ||           0 -> Buffer used during normal mode
                      |  ||| ||                (CC2=high).
                      |  ||| ||           1 -> Buffer used during fast AOI mode
                      |  ||| ||                (CC2=low).
                      |  ||| |+--------f: The shutter's normal (inactive) state
                      |  ||| |           (IRC-320/600, Pearleye P-007/030 only).
                      |  ||| |            0 -> Shutter normally open.
                      |  ||| |            1 -> Shutter normally closed.
                      |  ||| +---------g: Global frame output enable.
                      |  |||              0 -> FVAL always low.
                      |  |||              1 -> FVAL toggles.
                      |  ||+-----------h: Compatibility mode (CL interface
                      |  ||               only).
                      |  ||               0 -> Rev. 2.
                      |  ||               1 -> Rev. 1.
                      |  |+------------i: Continuous internal temperature
                      |  |                measurement (affects T=2 command,
                      |  |                only available on IRC-320/600,
                      |  |                Pearleye P-007/030).
                      |  |                0 -> continuous temperature
                      |  |                     measurement disabled.
                      |  |                1 -> continuous temperature
                      |  |                     measurement enabled.
                      |  +-------------j: IRC-340 support.
                      |                   00 -> Normal mode.
                      |                   11 -> IRC-340 mode.
                      |                   Other values are reserved.
                      +----------------k: Data multiplexing mode of the camera
                                          head.
                                          00 -> 12 bits slow, first word (e.g.
                                                IRC-300/320, NIR-300, Pearleye
                                                P-007).
                                          01 -> 12 bits slow, second word (for
                                                testing purposes).
```

```
                                          10 -> 12 bits fast (e.g. NIR-300F,
                                                NIR-600; Goldeye CL-008, P-008
                                                or P-032).
                                          11 -> 14 bits multiplex (e.g. IRC-600,
                                                Pearleye P-030).

i=<p16>         : Fast AOI mode offset for Two Point Correction. This offset
                  controls the starting point of correction data from memory,
                  if NIR-300F/NIR-600 and Goldeye CL-008/P-008/P-032 mode is
                  activated (see h=<p16>) and the CC2 signal from the grabber
                  is low. This parameter is specified in number of pixels
                  divided by 8. (*)

j=<p16>         : Mode of the automatic calibration function (k=<p16>).
                  <0000_000g_fffe_dcba>
                           | \_|| ||||
                           |   || |||+-a: 0 -> Do not select a new correction
                           |   || |||          data set.
                           |   || |||     1 -> Try to find a good correction
                           |   || |||          data set and activate it
                           |   || |||          (S=<p8>).
                           |   || ||+--b: 0 -> Do not take a new background
                           |   || ||           correction image.
                           |   || ||      1 -> Integrate frames to a new
                           |   || ||           background correction image,
                           |   || ||           activate the correction if
                           |   || ||           deactivated (U=1) and eventually
                           |   || ||           (see bit field "e") set offset
                           |   || ||           to mean value of the new
                           |   || ||           correction image (M=<p16>). Bit
                           |   || ||           field "f" specifies the number
                           |   || ||           of frames to integrate. See bit
                           |   || ||           field "b" of parameter U=<p8>
                           |   || ||           for description.
                           |   || |+---c: 0 -> (IRC-320/600, Pearleye P-007/030
                           |   || |            only:) Leave the mechanical
                           |   || |            shutter open for automatic
                           |   || |            correction data set selection.
                           |   || |       1 -> (IRC-320/600, Pearleye P-007/030
                           |   || |            only:) Close the mechanical
                           |   || |            shutter for automatic correction
                           |   || |            data set selection.
                           |   || +----d: 0 -> (IRC-320/600, Pearleye P-007/030
                           |   ||              only:) Leave the mechanical
                           |   ||              shutter open for background
                           |   ||              correction image integration.
                           |   ||         1 -> (IRC-320/600, Pearleye P-007/030
                           |   ||              only:) Close the mechanical
                           |   ||              shutter for background correction
                           |   ||              image integration.
                           |   |+------e: Activation of the offset calculation
                           |   |          for the background correction.
                           |   |          0 -> Do not calculate new mean value.
                           |   |               M=<p16> keeps its current data.
                           |   |          1 -> Calculate a new value and set
                           |   |               it as offset for the background
                           |   |               correction (M=<p16>). Bit field
                           |   |               "g" controls the calculation
```

```
                           |   |               method.
                           |   +-------f: Operation mode during image
                           |              integration. See bit field "b" of
                           |              parameter U=<p8> for description.
                           +-----------g: Offset calculation method for the
                                          background correction (M=<p16>).
                                          0 -> Set M=<p16> to the mean value of
                                               the newly captured background
                                               correction image.
                                          1 -> (IRC-320/600, Pearleye P-007/030
                                               only:) Set  M=<p16> to a linear
                                               interpolated  value depending om
                                               the current camera temperature.
                                               See parameter q=<p8> for
                                               correction data file.

k=<p16>         : Start the automatic calibration function. Depending on the
                  value of j different correction mechanisms are applied
                  to improve image quality. The parameter U may be affected,
                  too.
                    k=0          : Calibrate one-time.
                    k=<1..FFFF> : Start the calibration every k*256 frames.

l=1             : List contents of the flash file directory.

m=<p8>          : (IRC-320/600, Pearleye P-007/030 only:)
                  Operation mode of the temperature drift compensation.
                  A linear compensation term n*T + o + p is added
                  to the pixel data to correct a drift depending on the
                  temperature T. The temperature T is measured internally.
                  Slope and offset of the linear term are controlled by n=<p16>
                  and o=<p16>. Changing this parameters may void ex factory
                  calibration.
                  <000f_000m>
                      |    |
                      |    +---m : Operation mode.
                      |              0 -> Deactivated.
                      |              1 -> Drift compensation activated using
                      |                   the temperature measured internally.
                      |                   Please note: not all camera models
                      |                   are equipped with a temperature
                      |                   sensing feature.
                      +--------f : Bypass the filtering of internally measured
                                 temperature.
                                   0 -> Filter is enabled.
                                   1 -> Filter is bypassed.

n=<p16>         : (IRC-320/600, Pearleye P-007/030 only:)
                  Slope n of the linear drift compensation
                  term n*T + o. The value specifies the slope in counts per °C
                  and is represented in 10.6 bits fixed point two's complement
                  notation. See parameter m=<p8> for more details about drift
                  compensation. Changing this parameter may void ex factory
                  calibration.

o=<p16>         : (IRC-320/600, Pearleye P-007/030 only:)
                  Offset o of the linear drift compensation
                  term n*T + o. The value specifies an offset in counts and is
```

```
                    represented in 16 bits fixed point two's complement notation.
                    See parameter m=<p8> for more details about drift
                    compensation. Changing this parameter may void ex factory
                    calibration.

p=<p16>           : (IRC-320/600, Pearleye P-007/030 only:)
                    User specified parameter for the
                    temperature drift compensation. This is a value represented
                    in 16 bits fixed point two's complement notation. The value
                    is an additional offset value to fine adjust the camera. See
                    parameter m=<p8> for more details about drift compensation.

q=<p8>            : (IRC-320/600, Pearleye P-007/030 only:)
                    File number of the binary table data for
                    the temperature dependant mean value correction (see
                    parameter j=<p16>). The file consists of sampling points
                    given as binary value pairs (temperature, M). The correction
                    interpolates linearly between two sampling points and
                    extrapolates beyond the edges of the covered temperature
                    range. Correction data is recorded during the factory
                    calibration process. Changing this parameter or the specified
                    file contents may void ex factory calibration.

s=<p8>            : Configure the UART(s) for main serial communications. Changes
                    are activated immediately.
                    <eaa*_bbbb>
                     |\|   \__|
                     | |     +---b: Baud rate of the main UART and (if
                     | |            availiable) the second channel UART. The
                     | |            second channel UART supports 9600 to 115200
                     | |            Baud only.
                     | |              0 -> 110 Baud.
                     | |              1 -> 300 Baud.
                     | |              2 -> 600 Baud.
                     | |              3 -> 1200 Baud.
                     | |              4 -> 2400 Baud.
                     | |              5 -> 4800 Baud.
                     | |              6 -> 9600 Baud.
                     | |              7 -> 19200 Baud.
                     | |              8 -> 38400 Baud.
                     | |              9 -> 57600 Baud.
                     | |              A -> 115200 Baud.
                     | +---------a: Second channel UART configuration. This
                     |              channel is equivalent to the main UART
                     |              concerning the use as command interface.
                     |              But it is not intended to use both UARTs at
                     |              the same time, because they share the same
                     |              receive buffer. Output characters are always
                     |              sent to both channels.
                     |                00 -> Second channel UART off. The active
                     |                      serial communication port is selected
                     |                      by hardware jumper settings.
                     |                01 -> Activate second channel via the frame
                     |                      grabber's serial port. This is either
                     |                      Camera Link TG/TC or Pleora device
                     |                      port serial 0.
                     |                10 -> Activate second channel via Pleora
                     |                      device port bulk 0 (MODE:UART,
```

```
                 |                      GigE interface only).
                 |                11 -> Reserved.
                 +-----------e: Echo suppression.
                                 0 -> Each character received from the host
                                      is echoed back to it.
                                 1 -> No echo.

v=<p8>          : View file. Dumps all bytes of the specified file to the
                  serial interface. Raw data is output. If the file contains
                  binary data it may disturb a connected terminal program.
                  Please consider the available baud rate: large files may take
                  several minutes to transfer.

x=1             : Dump the complete processor RAM contents in hexadecimal
                  format. (*)


Command Overview (Upper Case Commands, Mainly for User Configuration)
---------------------------------------------------------------------
A=<p8>          : File number of the first cold (low) reference image
                  of the two point correction (Gain Offset Correction).
                  Changing this parameter or the contents of the specified
                  files may void ex factory calibration.
                    0           : No loading of any correction image. The
                                  memory content remains uninitialized at
                                  startup.
                    01..EF      : The correction data is loaded from the
                                  indicated file. If the following
                                  number also exists within the flash, it is
                                  loaded into the second page of the
                                  correction memory. This sequential loading
                                  procedure is continued as long as one file
                                  number in the sequence is missing or the
                                  maximum number (currently 32) is achieved.
                    FF          : 64 frames are integrated and the result
                                  is loaded into the active page of the
                                  correction memory as a new correction image.

B=<p8>          : File number of the first warm (high) reference image
                  of the two point correction (Gain Offset Correction).
                  Changing this parameter or the contents of the specified
                  files may void ex factory calibration.
                    0           : No loading of any correction image. The
                                  memory content remains uninitialized at
                                  startup.
                    01..EF      : The correction data is loaded from the
                                  indicated file. If the following
                                  number also exists within the flash, it is
                                  loaded into the second page of the
                                  correction memory. This sequential loading
                                  procedure is continued as long as one file
                                  number in the sequence is missing or the
                                  maximum number (currently 32) is achieved.
                    FF          : 64 frames are integrated and the result
                                  is loaded into the active page of the
                                  correction memory as a new correction image.

C=<p8>          : File number of the correction data for the bad pixel
```

```
                 correction. Changing this parameter or the contents of the
                 specified files may void ex factory calibration.
                   0             : No loading of any correction image. The
                                   memory content remains uninitialized at
                                   startup.
                   01..EF        : The correction data is loaded from the
                                   indicated file. If the following
                                   number also exists within the flash, it is
                                   loaded into a second page of the correction
                                   memory. The actually data page for correction
                                   is selected depending on the grabber's CC2
                                   signal state.

D=<p8>         : File number of the data for the 12-bits-LUT. Changing this
                 parameter or the contents of the specified files may void ex
                 factory calibration.
                   0             : No LUT data is loaded. The memory content
                                   remains uninitialized at startup.
                   01..EF        : The correction data is loaded from the
                                   indicated file.

E=<p8>         : Operation mode of the two point correction (Gain Offset
                 Correction). Changing this parameter may void ex factory
                 calibration.
                   0             : Deactivated. Image data is passed through
                                   transparently.
                   1             : Two point correction activated. Correction
                                   data A and B with set values J and K of the
                                   actual correction memory page S are employed.
                   2             : Two point correction deactivated. Test mode:
                                   Correction data A is output as image data.
                   3             : Two point correction deactivated. Test mode:
                                   Correction data B is output as image data.
                   4             : One point correction: Simple subtraction of
                                   the correction data A from the input data.
                                   In addition the set value J is added as
                                   offset to each pixel value.
                   5             : One point correction: Simple subtraction of
                                   the correction data B from the input data.
                                   In addition the set value K is added as
                                   offset to each pixel value.

F=<p8>         : Operation mode of the bad pixel correction.
                   0             : Deactivated. Image data is passed through
                                   transparently.
                   1             : Activated. Correction data C is employed.
                   2             : Deactivated. Test mode: Data output
                                   controlled by L=<p8>(*).

G=<p8>         : Operation mode of the LUT. Changing this parameter may void
                 ex factory calibration.
                   0             : Deactivated. Image data is passed through
                                   transparently.
                   1             : Activated.
                   2             : Deactivated. Test mode: LUT data is output
                                   sequentially.

H=<p8>         : Operation mode of the integrator / image store. This module
```

```
shares its memory with the background correction (U=<p8>).
This means that a new captured image with the command H=<p8>
overwrites the current image of the background correction.
The difference between H=<p8> and U=<p8> is the position
in the image processing chain: H integrates and outputs
data always at the beginning of the chain, which is
uncorrected camera raw data. U operates behind the two point
correction and thus integrates the data output of the two
point correction (see E=<p8>).
<d*cc_bbba>
 | \| \_||
 |  |   |+--a : Output mode.
 |  |   |       0 -> Pass image data through unchanged.
 |  |   |       1 -> Actual image memory content is output.
 |  |   +---b : Control of integration process. Assigning a
 |  |           new (not equal) value to this bit field
 |  |           starts the corresponding action. Please
 |  |           ensure that at least N+2 frames are output
 |  |           from the camera head and let this amount of
 |  |           time pass until a new value is assigned.
 |  |            000 -> No integration operation.
 |  |            001 -> Store the next image.
 |  |            100 -> Integrate 8 images and divide by 8.
 |  |            101 -> Integrate 16 images and divide by 16.
 |  |            110 -> Integrate 32 images and divide by 32.
 |  |            111 -> Integrate 64 images and divide by 64.
 |  |            (Other values undefined.)
 |  +-------c : Control of the data copy process (usually
 |              done after a new image has been integrated).
 |              Let pass through at least one complete frame
 |              (to be sure: wait two frames) from the camera
 |              to completely copy the data. Set this field
 |              back to 00 after copying. Notice that the
 |              set values J and K are not affected.
 |               00 -> No action.
 |               01 -> Copy to Target A. The image store
 |                     content of the integrator is subject
 |                     to be copied into the correction
 |                     data store as cold (low) reference
 |                     image of the two point correction.
 |               10 -> Copy to Target B. The image store
 |                     content of the integrator is subject
 |                     to be copied into the correction
 |                     data store as warm (high) reference
 |                     image of the two point correction.
 +----------d : State of the integration process (read only).
                0 -> Integration has finished.
                1 -> Integration is still in progress.
```

```
I=<p8>          : Set the mechanical shutter state manually (IRC-320/600,
                  Pearleye P-007/030 only).
                    0           : Shutter open.
                    1           : Shutter closed.

J=<p16>         : Define the set value for the cold (low) reference image of
                  the two point correction. It is a 16 bits value
                the 12 (or 14) most significant bits of which currently are used. For
                  each correction data set S=<p8> an own set value is stored.
```

```
                  All set values are loaded together from the flash file
                  N=<p8>. Changing this parameter may void ex factory
                  calibration.

K=<p16>         : Define the set value for the warm (high) reference image of
                  the two point correction. It is a 16 bits value of which
                  the 12 (or 14) most significant bits currently are used. For
                  each correction data set S=<p8> an own set value is stored.
                  All set values are loaded together from the flash file
                  N=<p8>. Changing this parameter may void ex factory
                  calibration.

M=<p16>         : Offset value for the background correction. This value
                  is added to every pixel value of the input image. It is
                  a 16 bits value of which the 12 (or 14) most significant bits
                  currently are used. If the automatic calibration function
                  with background correction image integration is used (see k
                  and j), this parameter is automatically set to the mean value
                  of the background correction image.

N=<p8>          : File number of the flash file containing the set values for
                  the two point correction (J,K). Changing this parameter or
                  the contents of the specified files may void ex factory
                  calibration.
                    0           : No set values are loaded. The memory content
                                  remains uninitialized at startup.
                    01..EF      : The correction data is loaded from the
                                  indicated file.

O=<p8>          : File number of the file containing the FPGA configuration
                  data. (*)

P=1             : Upload a new FPGA configuration file via the serial
                  interface and store it in the flash memory. After issuing
                  [CR] a special transfer protocol is processed. A currently
                  existing file will be overwritten. (*)

Q=<p8>          : Upload a general file via the serial interface and store
                  it in the flash memory using the specified file number.
                  After issuing [CR] a special transfer protocol is processed.
                  A currently existing file will be overwritten. WARNING: Do
                  not power down the device until the command prompt ">" has
                  returned! Otherwise file system corruption may occur, which
                  can leave the device inoperable.

S=<p8>          : Number of the correction data set to activate. The range of
                  valid values depends on the number of factory prepared and
                  currently loaded data sets. Please note that a change of S
                  affects the correction data for the gain-offset correction.
```

```
T=1               : Show sensor temperature warning state.
                    <***b_***a>
                        |    |
                        |    +--a : Sensor temperature warning state (this bit
                        |           is only valid for cameras with peltier
                        |           temperature stabilization like e.g. IRC-300,
                        |           IRC-320, IRC-600, NIR-300P, NIR-600P;
                        |           Pearleye P-007/030, Goldeye (CL/P)-008 SWIR
                        |           Cool, Goldeye (CL/P)-032 SWIR Cool).
                        |            0 -> The sensor temperature is OK.
                        |            1 -> The sensor temperature is outside the
                        |                 optimum range. This can result in a
                        |                 negative influence on the image
                        |                 quality. Please ensure that the
                        |                 temperature of the camera housing is
                        |                 inside the specified range.
                        +-------b : PLL state.
                                     0 -> PLL is locked.
                                     1 -> PLL is not locked. This should never
                                          occur under normal circumstances.

T=2               : Query camera's internal temperature value (IRC-320/600,
                    Pearleye P-007/030 only).
                    <dcb*_aaaa_aaaa_aaaa>
                     |||  \____________|
                     |||               +--a : Temperature in 1 / 16 °C (two's
                     |||                      complement).
                     ||+-------------------b : Result of LAST temperature
                     ||                       measurement attempt.
                     ||                       0 -> Unsuccessful (if "c" is 1, the
                     ||                            value "a" is valid anyway,
                     ||                            but contains old data from the
                     ||                            last successful conversion).
                     ||                       1 -> Successful.
                     |+--------------------c : 0 -> The content of "a" is invalid.
                     |                        1 -> The content of "a" is valid.
                     +---------------------d : Continuous temperature measurement
                                              is enabled (mirrors bit "i" in
                                              parameter h).
```

```
U=<p8>           : Operation mode of the background correction module. May
                   automaticly be set to 1 by the command k, depending on the
                   setting of parameter j.
                   <c**a_bbba>
                    |  | \_||
                    |  +---~+--a : Output mode of the background correction
                    |      |       module. Attention: split bit field!
                    |      |        00 -> Pass image data through unchanged.
                    |      |        01 -> Background correction activated. The
                    |      |              current background correction image is
                    |      |              subtracted from the input image and
                    |      |              the offset (M=<p16>) is added. A new
                    |      |              background correction image can be
                    |      |              taken by use of the command k=<p16> or
                    |      |              use of the bits "b".
                    |      |        10 -> Output the current correction image.
                    |      |              This mode changes the background
                    |      |              correction into a fixed image source,
                    |      |              no live image data from the camera is
                    |      |              output.
                    |      +---b : Control of integration of new background
                    |              correction image. Assigning a new
                    |              (not equal) value to this bit field
                    |              starts the corresponding action.
                    |               000 -> No integration operation.
                    |               001 -> Store the next image.
                    |               100 -> Integrate 8 images and divide by 8.
                    |               101 -> Integrate 16 images and divide by 16.
                    |               110 -> Integrate 32 images and divide by 32.
                    |               111 -> Integrate 64 images and divide by 64.
                    |              (Other values undefined.)
                    +----------c : State of the integration process (read only).
                                    0 -> Integration has finished.
                                    1 -> Integration is still in progress.

V=1              : Show firmware version and calibration data information.

W=<p8>           : Switch the destination of the optocoupler trigger input at
                   pins 10/11 of the 15-pin D-sub connector (GigE interface
                   variants only).
                     0           : Route directly to camera head (OR-ed with
                                   CC1 from frame grabber).
                     1           : Route to TTL_IN[0] of PT1000-VB board.

X=1              : Store the current parameter configuration to the flash.

Y=1              : Show the current parameter configuration.

Z=1              : Activates the factory default parameter configuration. The
                   saved configuration is only affected if you store the new
                   parameter values with X=1 afterwards. WARNING: The factory
                   default configuration of the firmware usually is not
                   identical to the camera specific ex-factory configuration.
                   Especially individual calibration information may be lost by
                   applying Z=1 followed by X=1!

?=1              : Show this help text.
```

GigE Vision feature mapping to serial commands

The following table shows the assignment of the available GigE Vision features to the corresponding serial commands.

GigE category (CameraSpecialFeatures)	GigE feature name	Feature visibility	Serial command
TwoPointCorrection	TPC_OperationMode	Expert	E=<value>
	TPC_CorrectionData_FileNumber	Expert	N=<value>
	TPC_SetValue_LowRef	Expert	J=<value>
	TPC_SetValue_HighRef	Expert	K=<value>
	TPC_FirstImage_LowRef	Expert	A=<value>
	TPC_FirstImage_HighRef	Expert	B=<value>
BackgroundCorrection	BGC_OperationMode	Expert	U=<value>
	BGC_OffsetValue	Expert	M=<value>
LUT	LUT_OperationMode	Expert	G=<value>
	LUT_CorrectionData_FileNumber	Expert	D=<value>
IntegratorAndImageStore	IIS_OperationMode	Expert	H=<value>
BadPixelCorrection	BPC_OperationMode	Expert	F=<value>
	BPC_CorrectionData_FileNumber	Expert	C=<value>
	AutoCalibrateOnce	Beginner	k=0
	AutoCalibrationMode	Expert	j=<value>
	AutoCalibrationInterval	Expert	k=<value>
	CorrectionDataSet	Beginner	S=<value>
	LoadParameterFromCameraFlash	Expert	Z=<value>
	SaveParameterToCameraFlash	Expert	X=<value>
	ParameterDump	Guru	Y=<value>

Table 45: GigE feature mapping to serial commands

GigE Vision feature reference for AVT Goldeye cameras

DeviceInformation

Feature	Description
DeviceModeName	Name of the attached camera model.
DeviceID	Unique 32-bit device ID of the AVT camera model.
DeviceUserID	User ID field. This field can be accessed (R/W) by the user to store an additional device identifier.
DeviceScanType	This feature specifies the scan type of the sensor (Areascan or Linescan).

Table 46: Standard: DeviceInformation

ImageSizeControl

Feature	Description
SensorWidth	Maximum width of the sensor in pixels.
SensorHeight	Maximum height of the sensor in pixels.
WidthMax	This feature represents the maximum width (in pixels) of the image after horizontal binning, decimation or any other function changing the horizontal dimensions of the image.
HeightMax	This feature represents the maximum height (in pixels) of the image after vertical binning, decimation or any other function changing the vertical dimensions of the image.
Width	This feature represents the actual image width expelled by the camera (in pixels).
Height	This feature represents the actual image height expelled by the camera (in pixels).
OffsetX	This feature represents the horizontal offset from the origin to the AOI (in pixels).
OffsetY	This feature represents the vertical offset from the origin to the AOI (in pixels).
DecimationHorizontal	Unused.
DecimationVertical	Unused.
PixelFormat	List with all available pixel formats of the camera, e.g. MONO12.
TestImageSelector	Enables or disables the internal test image generator of the camera.

Table 47: Camera standard feature: ImageSizeControl

AcquisitionControl

Feature	Description
AcquisitionMode	This feature controls the acquisition mode of the software. This feature works independently (!) of the chosen camera mode (Continuous, IOD hardware trigger, IOD hardware timer). It describes how many frames should be acquired.
AcquisitionStart	Starts the image acquisition of the camera.
AcquisitionStop	Stops the image acquisition of the camera.
TriggerMode	Modifies the trigger mode of the camera. When the trigger mode is *Off*, the camera will generate frames independently. When the trigger mode is *On* the camera is switched to the so called IOD (Image On Demand) mode. In this mode the camera waits for an external trigger signal or an timer pulse. To control exposure and dark time trigger mode must be switched to *On*.
ExposureMode	Start or stop the internal exposure signal timer.
ExposureTime	Sets the Exposure time (in microseconds).
ExposureTimeAbs	Sets the Exposure time (in microseconds).
ExposureTimeGranularity	Exposure time granularity.
ExposureTimeAbsMs	Sets the Exposure time (in milliseconds).
DarkTime	Sets the Dark time (in microseconds).
DarkTimeAbs	Sets the Dark time (in microseconds).
DarkTimeGranularity	Dark time granularity.
DarkTimeAbsMs	Sets the Dark time (in milliseconds).

Table 48: Camera standard feature: AcquisitionControl

AnalogControls

Feature	Description
Gain	This feature controls the selected gain as a raw integer value.

Table 49: Camera standard feature: AnalogControls

CameraSpecialFeatures

Feature	Description
AutoCalibrateOnce	Start the automatic calibration once. (k=0 command) The processing of this command can take several seconds, depending on the current image rate and the number of correction data sets available.
AutoCalibrationMode	Configure mode of the automatic calibration function. (j=<value> command)
AutoCalibrationInterval	Setup the automatic calibration interval. 0 = Calibrate one-time, 1..65535 = Calibrate every k*256 frames. (k=<value> command)
CorrectionDataSet	Number of the correction data set to activate. (S=<value> command)
ReloadCameraSpecialFeatures	Force a reload of all parameters from the CameraSpecialFeatures section.

Table 50: Camera special feature: Calibration and correction data

Feature	Description
SensorTemperatureState	Camera sensor temperature state. 0 = The sensor temperature is OK. 1 = The sensor temperature is outside the optimum range.
SensorTemperatureStateReg	Camera sensor temperature state register.
QuerySensorTemperatureState	Query camera sensor temperature state. (T=1 command)

Table 51: Camera special feature: Camera sensor temperature

Feature	Description
HighSpeedMode	Turn on or off the high-speed mode with reduced resolution (320x256 @118 Hz / 320x160 @186 Hz)

Table 52: Camera special feature: High-speed mode

CameraSpecialFeatures\TwoPointCorrection

Feature	Description
TPC_OperationMode	Operation mode of the two-point correction. (E=<value> command)
TPC_CorrectionData_FileNumber	File number of the flash file containing the set values for the two-point correction. (N=<value> command)
TPC_SetValue_LowRef	Define the set value for the **low** reference image of the two-point correction. (J=<value> command)
TPC_SetValue_HighRef	Define the set value for the **high** reference image of the two-point correction. (K=<value> command)
TPC_FirstImage_LowRef	File number of the first **low** reference image of the two-point correction. (A=<value> command).
TPC_FirstImage_HighRef	File number of the first **high** reference image of the two-point correction. (B=<value> command).

Table 53: Camera special feature: TwoPointCorrection

CameraSpecialFeatures\BackgroundCorrection

Feature	Description
BGC_OperationMode	Operation mode of the background correction. (U=<value> command) While reading this feature the MSB shows the state of the integration process. (0=Idle, 1=Busy)
BGC_OffsetValue	Offset value for the background correction. (M=<value> command)

Table 54: Camera special feature: BackgroundCorrection

CameraSpecialFeatures\IntegratorAndImageStore

Feature	Description
IIS_OperationMode	Operation mode of the integrator and image store. (H=<value> command) While reading this feature the MSB shows the state of the integration process. (0=Idle, 1=Busy)

Table 55: Camera special feature: IntegratorAndImageStore

CameraSpecialFeatures\BadPixelCorrection

Feature	Description
BPC_OperationMode	Operation mode of the bad pixel correction. (F=<value> command)
BPC_CorrectionData_FileNumber	File number of the correction data for the bad pixel correction. (C=<value> command)

Table 56: Camera special feature: BadPixelCorrection

Index